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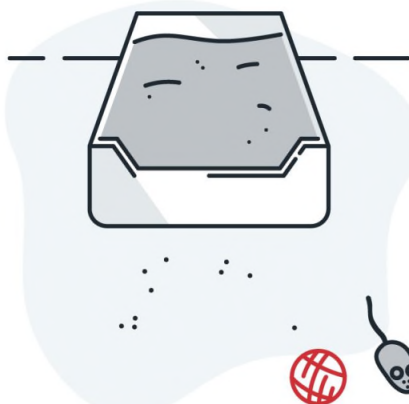


Innovations and Tips Every **Cat Parent** Should Know

For cat lovers, pets are part of the family. Fortunately for them, groundbreaking advancements in cat care aren't just for humans. New science-backed innovations, from high-tech health monitoring to new nutritional support, are helping pets live longer, healthier lives in sync with the people who love them. These smart tips can help set you on a path to happy, harmonious cat ownership.

1. Understand the Commitment

Taking care of a pet is a big responsibility. Plan for the time and budget owning a cat requires so you'll be in it for the long haul. Sadly, 3.2 million cats are surrendered to shelters every year in the U.S., according to the ASPCA. Knowing what to expect can help keep your furry friend settled for life.



2. Pick the Right Supplies

Cats need gear, including some toys, a comb for grooming, an ID tag, a cozy bed, a cat climber and scratching posts. They also need a complete and balanced, age-appropriate cat food to eat everyday as well as a litter box you'll keep clean to encourage healthy habits.

3. Proactively Monitor Health

"In a perfect world, every cat owner would have the time to monitor things like daily water intake, eating, sleeping and litter box habits to look for signs that could help detect potential issues early. But that's just not realistic for most pet owners, especially because cats will perform many of these activities during the night or when their owners are out of the house," says Ragen T.S. McGowan, PhD, pet behavior scientist and senior manager of global digital solutions at Purina. The Petivity Smart Litterbox Monitor System is a tech-savvy solution that is powered by Purina. It records data and alerts you via smartphone app to changes in litter box behavior that can be early signs of health conditions like diabetes, kidney disease, hyperthyroidism, urinary tract infections and obesity, allowing cat owners to proactively seek out veterinary care earlier and unlock better outcomes.



Here's how it works:

The Petivity Smart Litterbox Monitor System uses artificial intelligence to learn each cat's unique patterns to create distinct profiles and identify subtle, but meaningful, changes in weight, visit frequency, waste type and elimination schedule.



4. Choose Effective Food

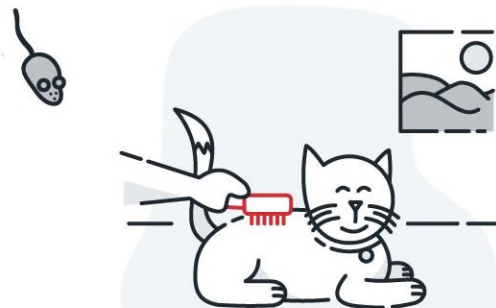
A nutritious diet is key for cat health, but thanks to new innovations, the right food can also make you more comfortable. Backed by more than a decade of research, Purina Pro Plan LiveClear is a first-of-its-kind cat food that safely reduces allergens found in cat hair and dander.

Here's how it works:

Cats produce the allergen Fel d 1 in their saliva. Purina Pro Plan LiveClear has a key, egg-sourced protein that binds to Fel d 1 and neutralizes it, significantly reducing the major allergen in cat hair and dander by an average of 47% starting in the third week of daily feeding.

5. Build a Strong Bond

Playing, cuddling and spending time with your four-legged family member are great ways to deepen your bond, and routine care steps such as feeding and brushing help build trust. You can also find games and activities to do together, and try to schedule playtime daily around the same time so your cat knows when to expect this coveted one-on-one time with you.



Optimal Cat Health: Powered by Purina

The Purina Pro Plan LiveClear and the Petivity Smart Litterbox Monitor System came from years of research and the constant pursuit of Purina's 500 pet experts worldwide to understand every element of pet health and to use that knowledge to enrich the lives of pets and the people who love them.

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*Trump supporters attend
a rally in Miami on Nov. 5,
leading up to the midterms
Photograph by
Andres Kudacki for TIME*



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A New Kind of Midterm

An off-year election is usually a referendum on the incumbent President, but it was the 45th who loomed over this vote—and held Republicans back once again

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Best Inventions 2022

TIME's annual list of innovative products doubles in size this year and ranges ever further, from a robotic scalpel and a swim cap for textured hair to a lithium battery that's both smaller and more powerful than the ones we have

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Under the Sun

After the heat-related deaths of thousands of migrant workers, hosting the World Cup compelled Qatar to develop protocols for working outdoors safely in a rapidly warming world

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Time Off



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CONVERSATION

How to help green innovation

THIS YEAR, OUR ANNUAL LIST OF BEST Inventions includes more innovations in sustainability than ever before. Among them is SCC55, a material that significantly enhances silicon-lithium battery performance. It's made by Group14, whose CEO, Rick Luebbe (*below*), spoke about boosting green ingenuity with Barun Singh, CTO of TIME CO2, a new platform to help businesses get to net zero. Read more on time.com

Singh: Group14 is slated to make batteries for Porsche EVs, and you just got a \$100 million grant from the Department of Energy, but many products don't get that far. What do we need to do to support the green-innovation ecosystem?

Luebbe: The struggle is getting from idea to commercialization. There are two chasms. One: you need to have data to get first seed investments, and you need funding to get the data. The second chasm is getting to commercial scale.



The problem with venture capital and these ideas is, they're not a fast return. So one option is funding incubators, where companies have very, very low-cost access to the best equipment and labs.

The [Department of Energy's] National Labs could have this capability, but they're so expensive to work with. If there's a way to subsidize a National Labs program, that could give true small businesses—less than 30 people—access to cutting-edge technologies to get their ideas proven to the point where they can get funded.

You've created denser, faster-charging EV batteries and are aiming to electrify aviation. How far off is that? You can't electrify a 747, at least not in my understanding of physics. But for regional flight, if you can charge it in the time it takes to get 20 passengers off and 20 passengers on, now it makes sense. Now you can fly all day long, you can capitalize quickly, your fuel expenses go down significantly, and you've got a clean CO₂ footprint. That technology is close. I think hyperregional electric flight is coming—the concept of the air Uber you can take to work to avoid traffic or to the beach. It's going to be transformational. □

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History newsletter

In TIME's weekly history email, staff writer Olivia B. Waxman digs into the stories behind the news and offers highlights from our archives. For more, visit time.com/history-newsletter

On TIME.com, the home page for the Best Inventions of 2022 list is built on TIME Sites. To learn how businesses use TIME Sites to tell their stories with easy-to-deploy, visually stunning microsites, visit timesites.com

Extreme heat

Thousands of migrant workers died in Qatar's construction boom over the past decade, sully the image of the kingdom hosting the World Cup. *Too Hot to Work* is a short documentary about how climate change is making outdoor work more dangerous, showing at time.com/qatar-doc



Investigation

For the past year, TIME correspondent Vera Bergengruen has tracked violent threats, harassment, and attacks targeting public officials—and found that most come from ordinary Americans. Read more at time.com/political-violence

On the covers



Photograph by Sergiy Barchuk for TIME



David Ramos—Getty Images



TIME illustration

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PERSON OF THE YEAR



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The Brief



MUSK'S \$8 PLAN TO SAVE TWITTER

BY ANDREW R. CHOW

The world's richest
man passes the hat

INSIDE

THE TROUBLE WITH MEGA
LOTTERY JACKPOTS

RETHINKING INDIGENOUS FOODS
AND THE "FIRST THANKSGIVING"

HOW TO MAKE YOURSELF
LOVE MORNINGS

PHOTOGRAPH BY JUSTIN SULLIVAN

THE BRIEF OPENER

E LON MUSK WANTS TWITTER TO BRING “power to the people.” One of his first strategies to do this? Charge the people—\$7.99 a month for a coveted blue check mark. Musk, who completed his \$44 billion purchase of the social media platform in late October, has been critical of Twitter’s verification system, in which high-profile users—journalists, government officials, brands, and other public figures—can apply for “verified” status that confirms their identity, and gives them prestige and prominence on the platform by placing a blue check mark next to their username. This designation, he argued in a tweet, creates a “lords & peasants system.”

Musk also needs Twitter to make money, fast. The company is now loaded with \$13 billion in debt and has not turned a profit for eight of the past 10 years. Last week, Musk began cost-saving efforts by laying off about half of Twitter’s workforce, or some 3,700 jobs.

So this new pay-to-verify plan called Twitter Blue is Musk’s first effort to open up new revenue streams. Like many other social media companies, Twitter has long been reliant on advertising, which is responsible for 90% of the company’s revenue. But this approach has proved disastrous for stock prices lately as ad spending stalls. And Musk is also facing a growing advertiser revolt from brands nervous about what he’s doing with the company. Under the new Twitter Blue system, Twitter users who want to keep using the site for free can do so—but their posts will be ranked lower and they will see twice as many ads, Musk tweeted.

The initial backlash to the proposal was fierce. “They should pay me. If that gets instituted, I’m gone like Enron,” the novelist Stephen King, who has 6.9 million followers, tweeted. In a Twitter poll posted by Musk ally Jason Calacanis, 81% of respondents wouldn’t pay for a blue check. Critics of the idea have voiced a slew of concerns. One is that trolls and other bad actors could buy a larger presence on the platform. When Twitter has expanded verification in years past, it has hit major snags: in 2017, the company granted a blue check to Jason Kessler months after he spearheaded the white-supremacist rally in Charlottesville, Va., giving him a much larger megaphone. (It was removed a week later after an uproar.)

Expanded verification could also help scammers flourish on the site. Public figures on Twitter are already besieged by impostors seeking to trick victims with crypto scams. Under a less-stringent system, one imagines, it would be easy for scammers to buy up blue-checked accounts and loop in victims before getting shut down.

It’s unclear exactly what measures Twitter will proactively take to confirm that people are who they claim to be. On Nov. 6, Musk tweeted that any account that impersonates someone else will be permanently suspended without warning—after comedian Kathy Griffin was suspended for changing her account name to “Elon Musk.” A few days later Twitter introduced an “official” label for verified high-profile accounts, but Musk seemed to contradict that, tweeting, “Blue check will be the great leveler.”

Then there’s the constant threat of misinformation. Musk may have foreshadowed a surge of fake news on the

site just three days after taking ownership when he tweeted out a far-right conspiracy theory about the attack on Nancy Pelosi’s husband. (Musk also tweeted out a plea for Americans to vote Republican in the midterms.) Critics worry that Musk’s new verification system would place debunked claims on the same plane as tweets from authoritative sources.

But while many users bristle at the idea of paying for social media, one of the most prominent critics of Big Tech—the technologist Jaron Lanier—has long argued that subscription-based social media could actually solve many of its major problems. At the moment, social media companies use your

data to sell ads: a “style of business plan that spews out perverse incentives and corrupts people,” he wrote in the *Guardian* in 2018.

MUSK NEEDS PEOPLE to start subscribing immediately. On Nov. 4, he defended the company layoffs—which were criticized for their speed and chaotic rollout—as being unavoidable for a company losing \$4 million a day. But even if all of the estimated 400,000 of Twitter’s verified accounts agreed to pay the \$7.99 a month, that would net Twitter only \$38 million—a drop in the bucket compared with existing annual revenue of \$5 billion. Musk is reportedly considering a slew of other monetization strategies, including “paywalled” videos and paid direct messages to high-profile users.

As fears of increased hate speech and misinformation grow, major companies including Pfizer, Audi, and General Mills have temporarily paused their ad spending on the platform. A collection of 50 civil-society groups signed a petition urging advertisers to go further and boycott the platform entirely if its safety standards are lowered, writing that they “have a moral and civic obligation to take a stand against the degradation of one of the world’s most influential communications platforms.” □

**‘They should
pay me.
If that gets
instituted,
I’m gone
like Enron.’**

—AUTHOR STEPHEN KING,
ON MUSK’S TWITTER SUBSCRIPTION PLAN



Life in the dark

Iren Rozdobudko, a 60-year-old writer and university lecturer, cleans dishes in her darkened Kyiv home during a blackout on Nov. 5. The Ukrainian national energy operator has scheduled power cuts in parts of the country in an effort to keep the electric grid from failing after Russian attacks, which Ukraine has said destroyed a third of power stations over eight days.

THE BULLETIN

Lula's win in Brazil gives the Amazon a fighting chance

THE RESULT OF BRAZIL'S OCT. 30 election was the best news the global climate fight has had in a while: Jair Bolsonaro, the far-right incumbent who has overseen an unrelenting surge in deforestation in the Amazon rain forest, narrowly lost out on a second term. Bolsonaro took 49.1% of the vote against 50.9% for Luiz Inácio Lula da Silva, a leftist former President who has pledged to protect the crucial carbon sink—and has a track record to back up his promises.

SHRINKING FOREST The fertile lands of the Amazon have always been a target for Brazil's farmers, loggers, and miners. In a bid to appeal to those groups, Bolsonaro gutted the budgets of agencies tasked with preventing deforestation. More than 12,800 sq. mi.

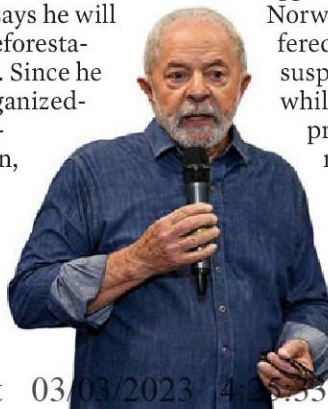
of the Brazilian Amazon were lost from 2019 to 2021—a 60% jump from the three years before. That's a sharp contrast to what happened under Lula's 2003–2010 government, which increased policing and created more sustainable jobs in the Amazon region. From 2004 to 2012, the annual deforestation rate fell by 80%.

HARDER TIMES Lula says he will now “fight for zero deforestation.” It won't be easy. Since he was last in charge, organized-crime groups have expanded in the Amazon, offering protection for those plundering natural resources, and doing violence to those who

challenge them. Bolsonaro's allies in Congress may rush to weaken environmental laws before Jan. 1, when Lula takes office and gets veto power.

GLOBAL FIGHT But Lula will be aided by an international community desperate to stop the release of the Amazon's stored carbon, which could trigger irreversible climate harm.

Norway and Germany have offered billions to fund programs suspended under Bolsonaro, while E.U. food importers are pressuring Brazilian agribusiness to end deforestation. “That's no longer a priority just for Brazil,” says Marcio Astrini, a Brazilian campaigner, “but for the world.” —CIARA NUGENT



THE BRIEF NEWS

GOOD QUESTION

Why do lottery jackpots keep getting bigger?

BY ANISHA KOHLI

ONE LUCKY TICKET SOLD AT JOE'S Service Center in Altadena, Calif., brought some very good news on Nov. 8: it held the only set of winning numbers in what was the largest Powerball drawing in U.S. history, with a jackpot worth \$2.04 billion. The incredible sum—more than 28,000 years' worth of earnings for the median American household—was a far cry from the first Powerball drawing, a now measly-sounding \$5.9 million win in 1992.

In the years since, the U.S. economy has been altered by recessions, inflation, demographic changes, and tech. At the same time, the major lotteries have changed their rules to ensure that jackpots grow. In 2012, for example, Powerball tickets went up from \$1 to \$2 per ticket. The game format has since undergone several changes to expand the number pool, lengthening the odds that any individual drawing results in a jackpot winner. The effect is that jackpots have swelled.

"In the industry, they have what they call jackpot fatigue, where what they found with research and practical experiences is that smaller jackpots no longer appeal to players," Keith Whyte, executive director for the National Council on Problem Gambling, tells TIME. "They're designing the games deliberately to maximize bigger jackpots that are rare. One way to do that is to make the odds worse so that the jackpot gets bigger."

Playing the lottery (or "the numbers" before states took over in the '70s and '80s) paved the way to legalized gambling, of which a slight majority of Americans disapproved a few decades ago. Polls today show that most Americans now approve.

"There has been a massive cultural shift, if you will," Whyte says, "and I do think that's also reflected in these larger jackpots."

BUT AS JACKPOTS grow, so do criticisms. Les Bernal, of the nonprofit advocacy group Stop Predatory Gambling, believes state-sanctioned lotteries are particularly exploitative because of how they affect marginalized groups. "It's a form of financial fraud that is only legal if you partner with the state government," he says.

Research suggests that state lottery retailers tend to be concentrated in lower-income areas and communities of color. A Consumer Federation of America survey found that a fifth of Americans believe the lottery is the only feasible way for them to acquire several hundred thousand dollars. And, as Whyte points out, large prizes

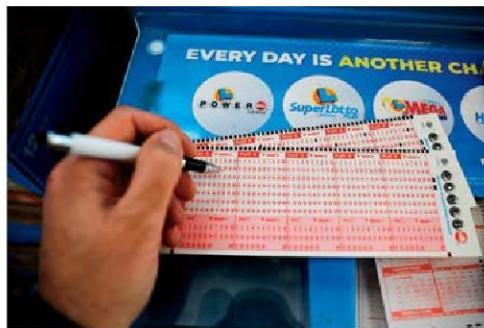
tend to attract even those who wouldn't gamble in other settings.

Drew Svitzko, Powerball product group chair and the Pennsylvania Lottery's executive director, tells TIME, "Since the mid-1960s, lotteries in the U.S. have provided entertainment for millions of players while

returning billions of dollars in funding for vital public programs, services, and good causes such as education, health and welfare, transportation, and the environment to benefit the quality of life for residents in their states with stringent government-compliance requirements." (A little more than a third of Powerball ticket-sale funds go to public services, though critics allege that some states use that money as an excuse to lower budgets; half goes to jackpots and the rest to cover costs.)

"What the 'critics' say is not a fair assertion, and unfortunately these are common misconceptions about the lottery industry that are not based on fact," Svitzko says. "People from all walks of life and income levels play lottery games."

What remains is the selling point: the potential—if exceedingly extreme unlikely—of winnings big enough to fuel anyone's daydreams. □



A player has a 1 in 292 million chance of hitting any Powerball jackpot

MILESTONES

DIED

Takeoff

Hip-hop trendsetter

TAKEOFF WASN'T THE biggest celebrity to come out of Migos, the Atlanta rap trio known for its swift ascent to the top of the charts in the early 2010s—but he was perhaps the group's best rapper. His effortlessly agile delivery had a long-reaching influence on trap music, a regional subgenre that would come to define modern American pop. Takeoff, whose real name was Kirshnik Khari Ball, was shot to death in Houston on Nov. 1 after a dispute at a bowling alley. He was 28.

Migos bypassed traditional industry gatekeepers by earning a rabid following online for songs like "Bad and Boujee" and "Versace." Before long, the triplet-based "Migos Flow" would become ubiquitous, with artists like Post Malone and Ariana Grande adopting the style. With poise and ferocity, and an ability to stuff dozens of words into fleet, forceful bars, Takeoff played a central role in that success.

—ANDREW R. CHOW



**DIED**

Jerry Lee Lewis

Demon saint of rock 'n' roll

BY RICHARD CORLISS

LIKE A RINGMASTER LETTING A LION OUT OF its cage to terrify and thrill the kids at the circus, Steve Allen unleashed the 21-year-old Jerry Lee Lewis to a prime-time TV audience on his variety show on July 28, 1957. As Lewis ripped into his debut hit, “Whole Lotta Shakin’ Goin’ On,” the same startled excitement seized the folks at home as when Elvis Presley made his first national TV appearance 18 months earlier. The moment was that epochal.

Lewis, who died Oct. 28 at age 87, had a far briefer purchase on stardom than Elvis—not least because the rockabilly icon made as much trouble as he did music. The Killer, as he was known, was a charter member of the Rock and Roll Hall of Fame known for two songs (“Great Balls of Fire” was the other).

He defined a new genre by revealing its tangled roots—in white and Black gospel stylings, in the boogie-woogie tickling and pounding of a barrelhouse piano. Lewis unleashed the saints and demons of rock ‘n’ roll. He was rock’s pioneer pianist-singer, preacher-sinner—the great blond thug of music that might have been God’s or the Devil’s.

From the beginning, Jerry Lee was addicted to music: inhaling all kinds, then reproducing and blending it on the family piano. When he was 20, Lewis made the rounds of Nashville record companies, but

the belligerent weirdness showed through. The Grand Ole Opry turned him down then, and for years thereafter. But Sam Phillips, Elvis’ mentor at Sun Records, signed Lewis to play piano for a Carl Perkins session on Dec. 4, 1956. That’s when Elvis and Johnny Cash dropped by. The four sang a bunch of gospel numbers and pop songs. Soon Lewis was selling records by the tons.

But his star fell. First he acknowledged that he had married Myra Gale Brown, the 13-year-old daughter of his cousin, in 1957. More trouble followed: in 1976, he shot his bass player Butch Owens in the chest—accidentally, it is said; Owens survived. Lewis’ fourth wife, Jaren Pate, died in a swimming pool in 1982. His fifth wife, Shawn Stephens, died a few months into their marriage; it was ruled a methadone overdose, but that doesn’t explain the bruised, bloody state of her corpse, found by police in the bedroom of their mansion.

Through it all, Lewis continued to play a brutal regimen of one-night stands, figuring he could keep on playing till Judgment Day, embodying so much of what was feral and profound about rock ‘n’ roll. As he announced at the conclusion of his belated, defiant debut at the Grand Ole Opry in 1973, “Let me tell ya somethin’ about Jerry Lee Lewis, ladies and gentlemen. I am a rock-‘n’-rollin’, country-and-western, rhythm-and-blues-singin’ mother-f-cker.” Satan couldn’t have said it better.

Corliss was TIME’s film critic. He prewrote this obituary before his death in 2015

DIED

► **Aaron Carter**, who rose to fame as a child pop singer, at 34, on Nov. 5.

► **Julie Powell**, whose book *Julie & Julia* reignited interest in Julia Child, on Oct. 26.

WON

A majority in the Israeli Knesset in a Nov. 1 vote, by a far-right coalition, setting up **Benjamin Netanyahu**’s return to power.

SUSPENDED

NBA star **Kyrie Irving** by the Brooklyn Nets, on Nov. 3, after he promoted an antisemitic film on Twitter.

APOLOGIZED

South Korean President Yoon Suk-yeol on Nov. 7, for a **crowd surge that killed 156** in Seoul on Oct. 29.

CRASHED

A plane into **Lake Victoria** in Tanzania on Nov. 6. Precision Air said 19 people died and 24 were rescued.

DIVORCED

NFL star **Tom Brady** and supermodel **Gisele Bündchen**, after 13 years of marriage, the pair announced Oct. 28.



THE BRIEF SOCIETY



NATION

Her tribe fed the Pilgrims. She's building on that history

BY OLIVIA B. WAXMAN/CHARLESTOWN, R.I.

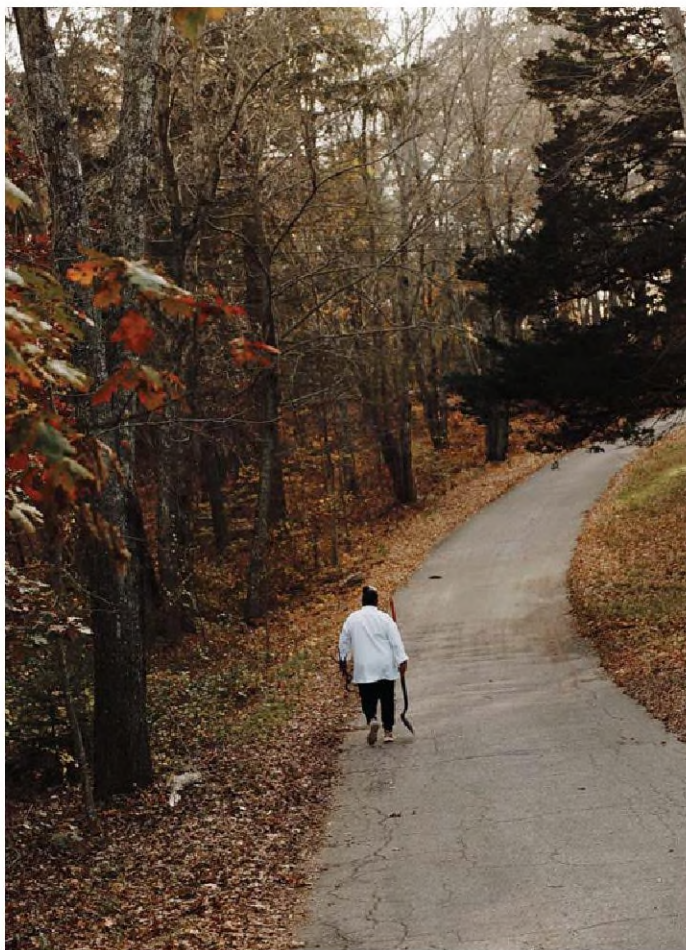
WHEN I FIRST CALL SHERRY POCKETT, SHE'S ON HER way out the door—headed to forage for mushrooms. But the Mashpee Wampanoag chef and longtime caterer invites me up to her restaurant, Sly Fox Den Too, in Charlestown, R.I., which specializes in East Coast Indigenous cuisine. There, in a little red house right by Narragansett Indian tribal lands, she cooks lunch—crisping duck skin like a potato chip—and explains that the sunflower oil she's using to prepare our meal can also be rubbed on your hair and skin to keep you looking youthful.

Pocknett, 62, is a member of the tribe best known for feeding the Pilgrims. Her restaurant—named for her fisherman father and Native American rights advocate Chief Sly Fox—is her own way of using her people's knowledge to feed Americans today. And she hopes the menu shows the breadth and depth of Indigenous foods, which are so much more than Thanksgiving turkey. In fact, at Sly Fox Den Too, which opened in June 2021, the only turkey parts are feathers sticking out of a handwoven basket hanging on the wall.

Pocknett explains that her people do eat turkey, but they also respect the birds for their smarts, and wear the feathers in their hair in order to absorb the turkeys' intelligence.

Her menu is based on a simple concept: "the food I grew up with," she says. She cooks what's local and what's in season. This time of year, that means foods like rabbit and quahogs, hard-shell clams native to the Atlantic coast. A photographer and I watch Pocknett prepare duck hash and venison—from a deer freshly killed by her son-in-law, which she skinned herself—topped with onion rings. The battered onion rings, she admits, aren't exactly a deep-rooted tradition: they're "from a mix," she says, "but I just love them." She also makes "journey cakes," cornmeal patties with dried cranberries, versions of which have a long history as road-trip food.

As she stews a reduction of beach plums harvested by her niece on Martha's Vineyard, to pair with the venison, Pocknett explains that many people don't realize this tart native fruit is both edible and delicious, so they go unpicked, left to the birds. To wash it all down, there are pinch pots full of iced tea made from boiled sassafras roots, which were plucked right behind the restaurant. Even if you've never heard of this common North American tree, you probably know the flavor—it was long the key ingredient in root beer. The feast is riffing on foods that appeared at the meal known as the First Thanksgiving in 1621.



According to historian David Silverman's *This Land Is Their Land*, waterfowl, venison, cornmeal, and seafood would have featured prominently at the colonists' table.

RESTAURANTS SPECIALIZING in Native American cuisine are rare—but a devoted core of Indigenous chefs are working to raise their profile. Owamni, an upscale eatery in Minneapolis focused on Indigenous cuisine and ingredients, won the James Beard Award for Best New Restaurant this year. Owner Sean Sherman, an Oglala Lakota chef, says Native American restaurateurs face the same challenges that other people of color face in the industry. "We've lost a lot of our own resources, especially when it comes to land-ownership," Sherman says, "and a lot of us coming out of the reservations are coming from poor communities."

Despite the fraught history, many Wampanoag tribe members still

*From left:
Pocknett, in
her restaurant;
her duck hash;
displaying sage;
foraging at her
daughter's farm*

**'We've
been here
for over
12,000
years. We
ain't going
nowhere.'**

enjoy gathering with their families on Thanksgiving Day—it's a day off, after all. CheeNulKa Pocknett, Sherry's nephew, who helps run an oyster and quahog farm in the Cape Cod area, plans to serve his family wild salmon that he caught in Washington State with nets he made himself. At his Thanksgiving table, there's always an extra plate with a little serving of everything for "the ancestors and spirits." Danielle Greendeer, who runs a store that sells traditional art and jewelry in the heart of Mashpee tribal land, harvested corn for the meal she's hosting at her home. She sees the occasion as a natural way to mark the First Thanksgiving, turning the holiday into a celebration of "survival." After all, she says, "the only way we can survive is by eating."

While customers at Pocknett's restaurant wait for their food to come out, they can page through a book called *If You Lived During the Plimoth Thanksgiving*—which retells the American myth from the perspective of the Wampanoag people. And yet, year-round, many customers still just want her to tell them about Thanksgiving. So she tells them the story she heard growing up. "We are a loving, giving people. We helped them, and then look what happened," emphasizing the statement with outstretched arms. "They took everything from us and killed us. We got wiped out. But not all the way. We're still here. We've been here for over 12,000 years. We ain't going nowhere." □

THE BRIEF HEALTH

5 ways to become a morning person

BY ANGELA HAUPT

ARE YOU A LARK—SOMEONE WHO GREETES THE DAY BEFORE 7 A.M.—OR A NIGHT OWL WHO thrives after dark? Some 30% to 40% of the answer depends on your genes, says Philip Gehrman, director of the Sleep, Neurobiology, and Psychopathology lab at the University of Pennsylvania. But your internal clock is mostly determined by other factors, like your age, sex, environment—and distance from the snooze button.

Few people are extreme larks or night owls, and most of us fall somewhere in between, says Jennifer Martin, president of the board of directors for the American Academy of Sleep Medicine. So if you want (or need) to start waking up at the crack of dawn, that's an achievable goal.

There are lots of good health reasons to rise earlier. Research has linked the early-bird life to better mental health and a lower likelihood of conditions such as depression and schizophrenia. Other research has found that morning people tend to be more proactive than late risers. Plus, waking up early is often the only chance for some people, like parents, to claim time and space for themselves.

If you're determined to rise with the sun—or simply catch more of the morning—know that transitioning to a new schedule requires time and effort. Sleep experts suggest these strategies.



1. Seek out as much natural light as possible

Bright-light exposure is critical in the a.m. because light suppresses melatonin, a hormone that induces

sleepiness. “The sun is the driver of our internal clock,” Martin says. When you wake up, pop outside for a brisk walk around the block, or sit out back while you sip a cup of coffee. Martin also advises against blackout curtains, which stop the morning light from having this wake-up effect. (If the brightness bothers you overnight, consider wearing an eye mask that you take off as you start to wake up.)



2. Ease in gradually

You can approach your journey to early rising in two ways, Martin says. One is by plunging straight into an early wake-up time, knowing that you'll feel tired during the transition

but will naturally start falling asleep earlier within a few weeks. But for some people—like those who need to drive long distances—those first few days of exhaustion aren't safe. In those cases, Martin recommends gradually easing in. “What I'll suggest to people is to shift half an hour, wait a few days, shift another half an hour, wait a few days, and then shift another half an hour,” she says. “That's a little easier for people to tolerate.”



3. Be consistent—even on weekends

Becoming a morning person is a seven-day-a-week job. Decide what time you're going to wake up every day, and stick to it without exception.

“If someone says, ‘I want to be more of a morning person during the week, but I want to sleep in on the weekends,’ that's not going to work,” says Gehrman.



4. Wind down in the evenings

To get at least seven hours of sleep a night, inch your bedtime earlier as you transition to a new schedule. Starting at least an hour before you hit the sack, cut back on how much exposure

to bright light you're getting, Gehrman advises. Research indicates that artificial-light exposure in the late evening suppresses your body's ability to generate melatonin, which could interfere with your ability to fall asleep and your sleep quality. If you want to ensure you fall asleep quickly, Britney Blair of the Stanford Center for Sleep Sciences and Medicine suggests trying small amounts of melatonin. A 300-mcg dose three to four hours before you plan to go to bed will help you start to feel sleepy, she says.



5. Plan something to look forward to

To entice you out of bed, Martin suggests treating yourself to something special you can enjoy first thing. “Now is the time to go buy your

favorite coffee or pick up some pastries to have when your alarm goes off at 5 a.m.,” she says. “You're not dreading it if you think of that.” She also recommends booking 6 a.m. fitness classes. Doing so helps hold you accountable, and provides an extra reason not to hit the snooze button again and again. If that doesn't appeal, use the time to connect with friends in other time zones, who may be commuting to work just as you're waking up.



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The View

WORLD

NEXT YEAR'S ENERGY CRISIS

BY SURIYA JAYANTI

For policymakers grappling with global energy shortages and households scrambling to pay record-high utility bills, some unwelcome news: this year's energy crisis is going to look mild compared with that of winter 2023–2024. That is going to be the real crisis. Any current energy planning must account for next year and beyond—where this winter is a problem, 2023's may be a catastrophe. ▶

INSIDE

THE MYSTERY OF
THE NATIONAL MOOD

PAKISTAN'S
PERILOUS POLITICS

PREPARE FOR
A COVID-19 SURGE

THE VIEW OPENER

The immediate problem is simple: there is not enough fuel, and therefore not enough electricity, so prices have skyrocketed for both. To a large extent, this is a result of decreased Russian exports of oil, natural gas, and coal, which have been hit by Western sanctions and other policy efforts to curb Russian revenues funding the war on Ukraine. Most Russian fuel supplies are still reaching international markets, however, because countries like China and India are happy to buy discounted product from a not-quite-marginalized Kremlin. But Russian exports are down too, approximately 18% in August compared with February. Notwithstanding a current drop in natural gas prices, Russian President Vladimir Putin is enjoying record energy revenues—over €200 billion since the start of the war on Feb. 24. In turn, markets are tight globally and countries are competing for limited supplies in what has become a zero-sum energy game.

THIS YEAR'S energy shortage is not just a Russia problem, however. Other factors keeping energy supply below demand are the unexpected surge in economic and industrial activity as countries awoke from COVID-19; refining capacity shortfalls caused by myriad fires, labor strikes, and maintenance activities; and overall inflation that puts upward pressure on prices, independent of supply constraints. The knock-on effects on electricity—high prices and lower-than-normal generation—exist because most power plants burn oil, coal, or natural gas. Utilities can neither raise prices on consumers without regulatory approval nor buy fuel imports with unchecked debt under existing laws that prevent risky

behavior by critical service providers. Many power plants around the world are struggling to continue generating electricity.

Meanwhile, there are not nearly enough nuclear, wind, solar, and other non-fossil-fuel alternatives, and hydroelectric plants worldwide are suffering because of climate-change droughts. The end result is current or forecast brown- and blackouts across the developing world, in parts of Europe, and maybe in the U.S. too, according to the U.S. Federal Energy Regulatory Commission. Developing countries are the worst off, because they have less ability

winter, or even a normal winter, at current consumption levels. But barring any unforeseen calamities, current natural gas reserves are probably enough for one winter if the E.U. succeeds in implementing both its voluntary and mandatory 15% electricity-usage reduction policies.

Of course, a warm winter and a 15% consumption reduction is a best-case scenario, and it is far from certain it will play out. During a cold snap in September and October, Poles were burning trash to stay warm. Europeans are hoarding firewood, and blackouts are already occurring in some countries. And, unfortunately, warm weather now coupled with energy subsidies is likely to disincentivize conservation of existing energy resources.

What is certain is that if Europeans, and the rest of us, could see ahead to 2023 and beyond, we would be doing everything in our power to save energy reserves now, in preparation. Europe is likely to be short by 20–30 billion cubic meters of its needed fuel in 2023. The bulk of what it can secure will come at a price so high that recession-hit governments will have trouble buying

fuel while simultaneously paying their populations' energy bills. Without the ability to bring new energy sources online in a hurry, the only tool governments have at their immediate disposal is cutting consumption. This is the equivalent of zipping up the tent in a hurricane, but it is what's available at this point.

Jayanti is an Eastern Europe energy-policy expert who served for 10 years as a U.S. diplomat, including as the energy chief at the U.S. Embassy in Kyiv, Ukraine, from 2018 to 2020



Firewood stored in an apartment building in Berlin. Europe is likely to be short by nearly 30 billion cubic meters of fuel in 2023

to absorb higher energy costs.

This is the situation we are in now, which winter will exacerbate, but it is going to be a walk in the park compared with next year. To start with, this year is not as bad as it could be. Although this year's winter will prove uncomfortable and expensive, Europe is nonetheless in a surprisingly good position. Bloc-wide, natural gas storages are now well over 90% of the annual target, which is actually at least 15% higher than their levels a year ago. This is not enough to heat and power the Continent through a cold



PSYCHOLOGY

Americans just aren't feeling each other

BY KARL VICK

A PUBLIC-OPINION POLL MAY SEEM A LOUSY PLACE TO look for a ray of hope. After all, a TIME/Harris survey conducted in the weeks before the midterm elections found that only about a quarter of Americans (27%) said their feelings about the state of the nation are “positive.” And yet.

Asked in the same poll about their own feelings, Americans were measurably less downbeat. For every topic we asked about, more people judged it to be bumming out the country than said it was bothering them personally. While 63% say the economy is negatively affecting the mood of the country, for instance, only 57% called it a drag on their own outlook. Fifty percent of people said rights issues, including race relations, were adversely affecting the nation's mood, but only 39% said they affected their own. A similar gap showed up when the survey offered a list of emotions, asking people to choose the one they had felt most over the previous 30 days—and later, to choose the one that described the mood of Americans overall.

“Given the near-constant stream of doom and gloom Americans absorb from the news, it is unsurprising that they characterize the nation's mood as frustrated (23%), anxious (12%), and disappointed (11%),” notes Will Johnson, CEO of the Harris Poll. “The good news, however, is that the leading adjectives they use to describe their own mood are hopeful (15%) and happy (14%). Only 14% report that they themselves are frustrated.”

**People
rate the
national
mood as
worse than
their own**

WHAT'S GOING ON? There's reason to believe that, when asked to describe the state of the nation, people naturally describe the one they see on TV or read about on their phones—a place defined by strife, confrontation, and extremes. And that's before being amplified by social media. In other words, America's citizens may not be nearly as distressed as America's political discourse is—a discourse that, of course, includes polls that tell us how distressed we are.

To dig deeper, a Boston-area think tank called Populace has endeavored to measure “private opinion,” or views that a person holds but might not share with a pollster. Told of the persistent mood-perception gap in the TIME/Harris survey, Populace founder Todd Rose said, “I would predict the gap is actually substantially larger.”

The heart of the issue, Rose theorizes, is that people likely sense that certain responses are “expected” based on how they've identified themselves. “Most people want to be with their group, not against their group,” he says. “So whenever you're reading the mood of the group, people will kind of go toward what they're supposed to feel or say.”

To get beyond those expectations, Populace will slide a “sensitive” statement in with four other statements that are both less delicate and also previously polled, then ask the subject to select three statements they agree with. After sorting the results, Populace was able to learn this past spring that, while 43% of people had told a pollster that “public schools focus too much on racism,” only 33% said that when asked less directly. Similar gaps showed up on abortion, and the effectiveness of masks against spreading COVID-19.

In other research, Populace has found Americans largely agree on which issues are most important to them—but assume (incorrectly) that other people feel different. The persistence of that perception, Rose notes, “is the same as being truly divided.” But if we're actually not, that's more than a ray of hope. It's a shaft of sunlight. □

THE VIEW

THE RISK REPORT BY IAN BREMMER

Pakistan's poisonous politics



PAKISTAN'S POLITICS were plenty toxic even before the failed assassination against ousted former Prime Minister Imran Khan. When Khan was removed from power following a parliamentary vote of no confidence in April, he claimed Pakistan's military and its friends in Washington wanted to silence him. He then kicked off a series of protest marches that have drawn massive crowds.

In October, Khan insinuated that the army had killed a journalist, an uncharacteristically blunt frontal assault on Pakistan's army, and the country's head of military intelligence felt compelled to call an unprecedented public press conference to deny the charge. Officials in the current government, led by Shehbaz Sharif, accused Khan of terrorism, illegally receiving money from foreigners, and other forms of financial fraud. Then, during a protest rally earlier this month, Khan was shot in the leg, some of his supporters were wounded, and one was killed.

It's all part of a three-way fight between Pakistan's current government, its powerful and politically meddlesome military, and Khan, a former cricket star and playboy who governed as a Muslim fundamentalist. Khan blamed the attempt to kill him on Prime Minister Sharif, the Interior Minister, and a senior military officer. If some Pakistanis who doubted past charges of conspiracy

find them more plausible now that shots have been fired, critics within the government have accused Khan of staging the shooting to discredit Sharif and win sympathy.

The suspected gunman provided conflicting accounts of his own motives before finally settling on "blasphemy" as Khan's unpardonable offense. Khan himself claims there was more than one shooter. The government and military are dragging their feet on launching

very few hands. He is popular enough that his rivals and enemies have no intention of giving him that opportunity. The government is not required to hold elections until October 2023.

KHAN'S CHALLENGES and this latest political intrigue will only make it harder for Sharif's government to manage an economy in deep trouble. Decades of waste and corruption have taken a cumulative toll, and Khan's populist economic policies as Prime

Minister only added to the IOUs of a country that was already billions in debt, particularly to China. Recent floods that killed almost 1,500 people and impacted millions of lives have inflicted tens of billions of dollars in damage. Inflation has reached historic heights. Current Prime Minister Sharif has worked hard to win a \$7 billion relief package from the International Monetary Fund, which would require Pakistan to, among other things, cut state subsidies to



Supporters of former Prime Minister Khan's party protest on Nov. 4 in Karachi to condemn the shooting of their leader

a formal investigation. Even with one, the mysteries surrounding this event are unlikely ever to be solved, and each side will believe the version of events it chooses to credit.

The political temperature continues to rise. Since Oct. 28, the still popular Khan has led what he's billed as another "Long March" across the country toward Islamabad, the capital, to protest his ouster as Prime Minister and to demand early elections, which he says would restore him to power with a large popular mandate to clean up corruption and uproot a deep-state-style conspiracy to keep power in a

help Pakistanis pay their soaring energy bills. An austerity budget and more spending cuts are badly needed to bring Pakistan's books a bit closer to balance, but Khan, seeing an unmissable opportunity to attack the government, has denounced the cuts. He claims, implausibly, that if he becomes Prime Minister again, the cuts won't be needed.

A confrontation is coming. Once his leg has sufficiently healed, Khan will rejoin thousands of his supporters and continue their march toward Islamabad. Men holding guns will be waiting, and no one is likely to back down. □

FAREED KHAN—AP



Subway riders, some masked, wait on a train platform in New York City



The Coronavirus Brief

By Jamie Ducharme

HEALTH CORRESPONDENT

THOUGH IT MAY FEEL AS IF COVID-19 is a thing of the past, researchers fear another surge is coming, just in time for the holiday season. Here are the precautions experts say you should be taking this year.

GET YOUR OMICRON BOOSTER now instead of timing it for just before holiday events, says Dr. Kristin Moffitt, an infectious-disease physician at Boston Children's Hospital. It takes a couple of weeks after vaccination for your body to mount an immune response, and that protection should stay strong for at least two months. "If people got boosted now, their maximum immunity from that booster would get them through the end of 2022," Moffitt says.

TAKE A RAPID TEST before you gather to avoid unknowingly spreading the virus to your loved ones, suggests Dr. Roy Gulick, chief of infectious disease at Weill Cornell Medicine and NewYork-Presbyterian. At-home tests should pick up newer variants like BQ.1—but if you test negative and have classic symptoms like sore throat, body aches, and fever, you should still stay home.

STAY SAFE DURING TRAVEL. Masks aren't required for most travel anymore, but Gulick recommends wearing one—at least for certain portions of your trip. In general, air quality is better on planes than on trains and buses. But Gulick recommends masking in the airport and when your plane is taxiing, since filtration systems may not be turned on when the plane is grounded. And if you're traveling by bus or train, it's a good idea to mask during your entire journey.

DON'T FORGET ABOUT other viruses. In addition to COVID-19, influenza and RSV are sickening lots of people right now. Moffitt says that's an extra reason to take precautions like masking during travel and avoiding high-risk settings such as crowded indoor events before your holiday plans, particularly if you'll be seeing anyone immunocompromised or otherwise vulnerable.



For more COVID-19 news, sign up for the Coronavirus Brief at time.com/coronavirus

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*John Fetterman's
triumph in
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could preserve
the Democrats'
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PHOTOGRAPH BY JIM LO SCALZO



POLITICS

HOW THE DEMOCRATS DEFIED HISTORY

Both parties braced for a GOP rout,
but voters delivered a stalemate that
promises more turmoil ahead

BY MOLLY BALL

POLITICS

T

THE STAGE WAS SET FOR A TRIUMPHANT scene: a capacious Washington ballroom, a sparkling lectern flanked by American flags, the words TAKE BACK THE HOUSE plastered in big letters on the wall behind it. Going into the Nov. 8 midterm elections, Kevin McCarthy, the House GOP leader, was sure he and his party would have much to celebrate.

But the triumph never materialized—and as the night wore on, neither did McCarthy. The bar closed; partygoers limped toward the exits. Finally, at 2 a.m., McCarthy emerged to proclaim what he wished to be true: “It is clear we are going to take the House back,” he said. “When you wake up tomorrow, we will be in the majority.”

As the dust settled on a most unusual election, many signs still pointed to McCarthy’s prediction coming to pass—but by a slim margin that surprised both parties. In the Senate too, Republicans fell short of their hopes, with control of the chamber still undecided and a December runoff pending in Georgia. The ingredients had been there for a Republican rout: four-decade high inflation,

real wages shrinking, gas prices up, an unpopular aging President. But the predicted red wave was barely a trickle.

Vulnerable House Democratic incumbents held onto contested seats from Virginia to Ohio to Kansas. The Democrats flipped governorships in Maryland and Massachusetts while thwarting challenges from Donald Trump acolytes in Michigan, Wisconsin, and Pennsylvania. The abortion-rights side swept ballot initiatives in Michigan, Kentucky, California, and Vermont. In Pennsylvania, Democratic Lieutenant Governor John Fetterman defeated celebrity doctor Mehmet Oz, taking a Senate seat previously in GOP hands. Democrats hung on in Senate races the Republicans targeted in New Hampshire, Colorado, Washington, and likely Arizona. The far-right GOP Congresswoman Lauren Boebert appeared in danger of a shocking loss in a deep-red Colorado district.

Republicans’ biggest cause for celebration was in Florida, where Governor Ron DeSantis won a staggering victory in the onetime swing state. Republicans retained Senate seats in Ohio, Florida, and Wisconsin; again vanquished Democratic gubernatorial candidates Stacey Abrams and Beto O’Rourke in Georgia and Texas; and picked up House races in New York, even upsetting the chairman of the Democratic Congressional Campaign Committee, Sean Patrick Maloney.

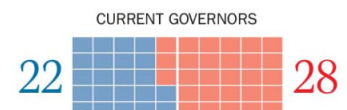
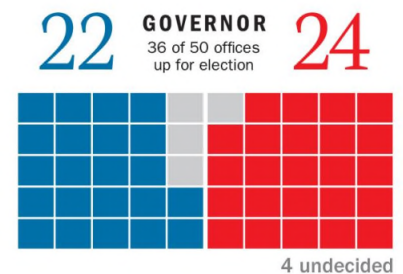
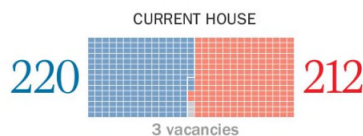
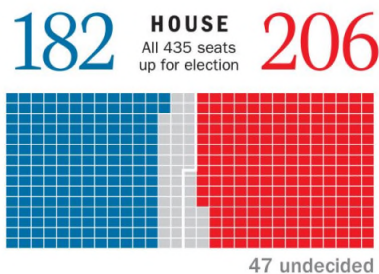
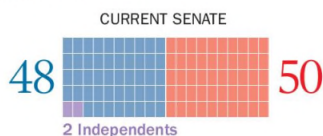
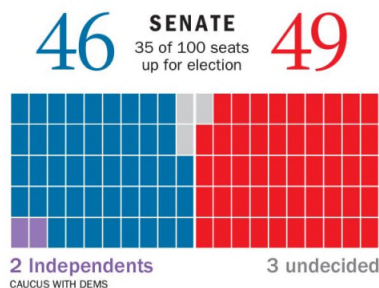
While the balance of power in Washington shifted in the Republicans’

direction, their failure to capitalize on a favorable political environment will lead to more recriminations than celebrations. And while Democrats breathed a sigh of relief, voters’ dissatisfaction with the country’s direction was evident, particularly when it came to the economy and public safety. Caught between Democratic fecklessness and Republican lunacy, voters delivered a stalemate—not a vote of confidence, but a repudiation of sorts for both parties.

DESPITE THE MIXED VERDICT, messages emerged from the morass. Americans broadly support abortion rights and continue to consider them a high priority in the wake of the Supreme Court’s June overturning of *Roe v. Wade*. The electorate is angry, frustrated, pessimistic—and motivated, with turnout approaching 2018’s record levels. And in the first national election since Trump left office, his continued attempts to remake the GOP in his image appeared more poison pill than Midas touch, with Trumpist candidates underperforming across the map.

At the same time, the mainstream Republicans who ignored Trump often prevailed, holding governor’s mansions in Georgia, Ohio, and New Hampshire. Whether despite or because of panicked liberals’ insistence that democracy itself was under siege, election deniers were defeated in droves. Losing candidates conceded gracefully and election

THE RESULTS 🐾 DEMOCRAT 🐾 REPUBLICAN



NOTE: ELECTION RESULTS AS OF 5 P.M. NOV. 9. SOURCES: AP; OFFICE OF THE CLERK, U.S. HOUSE OF REPRESENTATIVES; GALLUP; NATIONAL CONFERENCE OF STATE LEGISLATURES. CIRCLES ARE SIZED TO THE BODIES THEY REPRESENT, SO A 6-SEAT SENATE GAIN IS PROPORTIONAL

systems functioned as planned, bolstering confidence in institutions of governance. The two parties traded victories, but the election was a triumph for normal politics in abnormal times.

The question now is what lessons the parties take as they gear up for the 2024 presidential race. Would Democrats, whose policies arguably contributed to historic inflation and rising crime, be jolted out of their denial and find ways to address the issues closest to voters' daily lives? Would Republicans, having squandered opportunities for the third cycle in a row at the hands of a failed ex-President under multiple investigations, steer away from the toxic alternate reality that has claimed so much of their base?

Sometimes an election settles the debate, delivering a clear statement on what lurks in America's murky heart. This one offered up more questions than answers—with the promise of more turmoil ahead.

JUST TWO YEARS AGO, President Biden and the Democrats won office promising to banish the COVID-19 pandemic, unify the country, and restore a sense of stability. Before Biden was even inaugurated, it became clear these would be difficult promises to keep, as a violent Trump-summoned mob stormed the U.S. Capitol, disrupting the Jan. 6 tabulation of Electoral College votes.

But Democrats couldn't blame

Republican intransigence for the missteps that soured the public on the party in power. Their \$1.9 trillion American Rescue Plan at first seemed like an early triumph, but it soon became clear the economy was overheated and inflation was no mere transitory phenomenon. The vaccines formulated during the Trump presidency were speedily distributed, but proved less effective against new variants as the Biden Administration struggled to roll out testing and articulate clear guidance. A trickle of migrants across the border became a flood; cities grappled with surging crime and homelessness; and the August 2021 withdrawal from Afghanistan became a deadly debacle.

A President who'd campaigned on competence, comity, and a mastery of Congress struggled to get legislators on board with his plans for infrastructure and social spending. Republicans found galvanizing themes in the culture wars over racial equity and transgender rights, which were particularly acute in

public schools already struggling with the aftermath of pandemic closures. That November, the GOP won the governorship in Virginia, where Biden had won by 10 points.

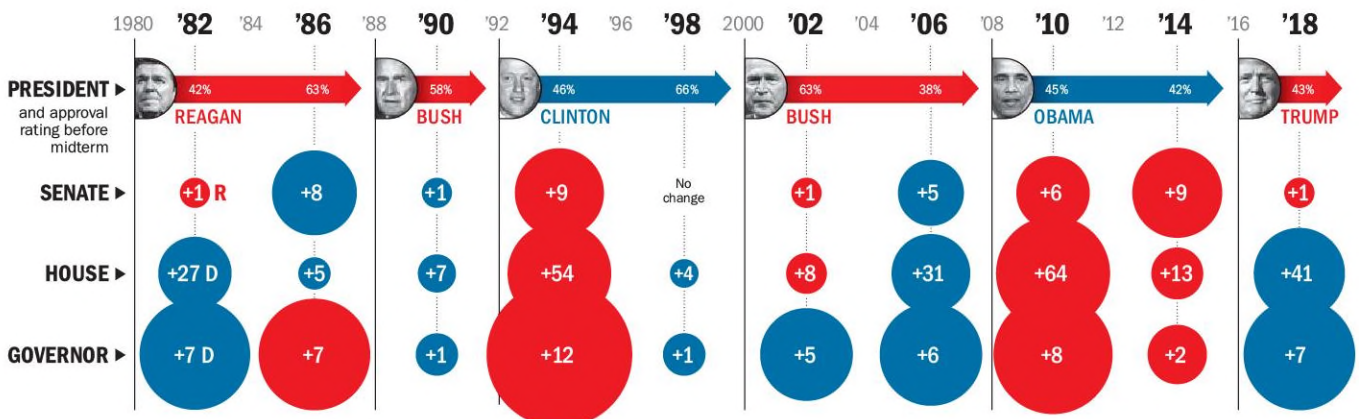
But if Democrats appeared to be off track, Republicans were on a fast train to la-la land. Given the opportunity to repudiate Trump after Jan. 6, McCarthy embraced him instead, cementing Trump's place as the party's leader. Candidates flocked to Mar-a-Lago to kiss Trump's ring, where the principal litmus test was validating his delusional insistence that the 2020 election was stolen.

In June the Supreme Court delivered a shock to the body politic, overturning the *Roe v. Wade* ruling that had kept abortion mostly legal for 50 years. The issue has long divided Americans, but it soon became clear that voters strongly rejected the court's action. Deeply conservative Kansas rejected an antiabortion referendum by a nearly 20-point margin in August.

Republicans hammered perceptions of surging crime and a flood of border crossings—chaotic situations that Democrats seemed to have no plans to address. The party's message on crime was so unconvincing that Democratic pollster Stan Greenberg advised candidates to avoid the issue altogether. As Democrats frantically tried to change the subject, emphasizing abortion rights and the fate of democracy,

**Caught between
Democratic
fecklessness and
Republican lunacy,
voters delivered
a stalemate**

THE MIDTERM EFFECT The party out of the White House typically gains ground in nonpresidential elections. Circles represent two-year seat gains



TO A 26-SEAT HOUSE GAIN AND A 3-SEAT GOVERNOR'S GAIN. CONGRESSIONAL GAINS DO NOT NECESSARILY RESULT IN CONTROL OF THE CHAMBER. CALCULATIONS REFLECT IMMEDIATE ELECTION RESULTS AND DO NOT INCLUDE INDEPENDENTS OR OTHER PARTIES

POLITICS

voters looked poised to deliver a brutal verdict on their policy failures and out-of-touch priorities.

Republicans were so convinced this would be the case that they barely tried to offer a credible program or craft a sensible, moderate image. Following Trump's lead, they nominated a clown car of politically inexperienced candidates in high-profile races. Up and down the ballot, they put up nominees who participated in Jan. 6, cast doubt on elections, or pledged to ban abortion completely. A highly mobilized electorate clearly sought a change in the country's direction. But in case after case, they saw the GOP alternative as beyond the pale. "It turns out," says Republican pollster Whit Ayres, "that trying to overturn an election is not widely popular with American voters."

There are no moral victories in politics, and if the House and perhaps even the Senate are in Republican hands, the GOP's power in Washington has significantly expanded. But Democrats held their own in brutal political conditions. A President's party has not been this successful in a midterm election since Republicans won the 2002 midterms in the wake of 9/11 under George W. Bush.

THE DAY BEFORE the election, Ron DeSantis took the stage in a sweaty equipment warehouse a few miles down the road from Mar-a-Lago, behind a lectern with a yellow DON'T TREAD ON FLORIDA sign, the traditional serpent replaced with a rearing alligator. Democrats, DeSantis argued, were about to be "blown out," because of their own failed policies. Meanwhile, in Florida, he said, elections run smoothly, roads get repaired, the budget has a surplus, police are respected, and children aren't indoctrinated at school. People view the state "not just as a refuge of sanity, not just as a citadel of freedom, but also a place where we're going to maintain public order," he boasted.

DeSantis' prediction may not have borne out nationally, but in Florida it was vindicated. With a mix of culture-war politics and competent governance, he articulated a case not merely for the pursuit of power, but also for an agenda that voters found effective even as liberals decried it as offensive. "While



DeSantis rallies supporters in Miami on Nov. 7 before cruising to a victory

around the country you saw freedom withering on the vine, we in Florida were the ones that held the line—for you, for your families, for jobs, for businesses, for our kids' education," he said.

What Republicans elsewhere may do with their new but precarious power is less clear. McCarthy once predicted a landslide of as many as 60 Republican seats, with which the party promised to hound the Biden Administration. Washington braced for a possible return to gridlock and obstruction, with debt-limit crises, government shutdowns, and impeachments of officials up to and including the President looming on the horizon. Now, with a far narrower majority projected, it's unclear whether McCarthy will even be able to claim the speakership he has long sought. No one has yet risen to challenge him, but the blame game is already beginning.

Some Democrats believe the worst is now behind their party. Their actions to bring down gas prices and inflation will continue to bear fruit, partisans hope, while the crime wave and COVID-19 era will recede. The result should quiet the chatter about replacing Biden, though his age remains a concern to Democratic insiders and the base alike. The party's divisions haven't gone away, but its apocalyptic warnings that American democracy is imperiled have been tempered by a fresh boost of confidence.

The question now is who Democrats

may face in 2024. The midterms could hardly have gone better for DeSantis, who offered Republicans a resounding triumph on an otherwise disappointing night. And it could hardly have gone worse for Trump, who has teased a major announcement on Nov. 15. The former President has been privately seething for months about his onetime protégé's success.

On Nov. 6, Trump held a rally in Miami to which DeSantis was conspicuously not invited. It had all the now familiar trappings of the former President's carnival-style tours, with a crowd of thousands decked out in MAGA garb. Attendees I spoke to grumbled about the deep state and the stolen election; most fervently wished Trump would run again. But at other Republicans' campaign events I've attended this cycle, there have been vanishingly few of his signature red hats. When I went to see Herschel Walker campaign in Georgia in September, every person I interviewed brought up DeSantis, unprompted, when I asked what they thought about Trump's future prospects.

For an hour and a half, Trump plowed through his familiar list of grievances. Dark clouds massed behind him as the sun began to set. As spooky music began to play, the downpour began. People streamed toward the exits, covering their heads with their LET'S GO BRANDON flags. Trump stood in the dark as the rain came down, basking for the moment in his movement's adulation. —With reporting by BRIAN BENNETT, LESLIE DICKSTEIN, MARIAH ESPADA, and SIMMONE SHAH

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Best Inventions

Innovation booms in a rapidly shifting world. So for our annual list of the world's most exciting innovations, TIME editors combed through more products and services than ever, and added categories that focus on sustainability. The result: 200 amazing inventions that make the world better, smarter, or just more fun.

AR & VR

AUGMENTED JOB TRAINING

Magic Leap 2

Magic Leap sees a big future for augmented reality (AR) in workplaces. With this new headset, which can overlay 3D images and text on a user's surroundings, the company is focused on employers in health care, manufacturing, retail, and other sectors. Home-improvement giant Lowe's has begun outfitting workers with Magic Leap 2 so they can see what a store shelf should look like and then tweak displays. Manufacturers are using it to speed up training of technicians on factory floors.

Fifty percent smaller than its predecessor, the headset offers a wider field of view and crisper image resolution. New "dynamic dimming" technology blocks distracting light to create an immersive work environment. Magic Leap's open developer platform lets its customers create custom AR solutions to suit their needs. —Chad de Guzman

With reporting by Leslie Dickstein, Mariah Espada, Barbara Maddux, Simone Shah, and Julia Zorthian

PHOTOGRAPH BY SERGIY BARCHUK FOR TIME

BEST
Inventions
2022

Accessibility

FEELING THE FIELD

Field of Vision

The fervor of live soccer is infectious, but for the millions of fans with visual impairment, it's nearly impossible to follow the action in real time. So Irish haptic-tech startup Field of Vision created a tablet-like device that sits in users' laps, allowing them to follow the ball's movement up and down the field with their fingertips—"a bit like a Ouija board," says co-founder David Deneher. Special cameras positioned around the pitch track the ball and relay its exact position to the device, which vibrates when players, say, slide tackle. (Descriptive audio commentary is also integrated.) A prototype is now being tested in partnership with Dublin's Bohemian Football Club.

—KALEN GOODLUCK

Apps & Software

BLOCKING HACKERS

Nord Security NordVPN

On an internet rife with malware, protecting personal data is essential. One solution: virtual private networks (VPNs), which encrypt data, shielding you from the prying eyes of companies, governments, and hackers. Once the preserve of those willing to tolerate slower connection speeds, VPNs are now fast and user-friendly—thanks in part to NordVPN. With its latest version, released in March, the service blocks malware and malicious ads—most VPNs don't—while also offering a suite of cybersecurity services for consumers and businesses, including encrypted password managers and cloud storage. Nord Security, the Lithuania-based startup behind NordVPN, was valued at \$1.6 billion earlier this year.

—BILLY PERRIGO



Style

Out of thin air

Aether Diamonds

Companies selling lab-grown diamonds often appeal to consumers' sense of ethics and sustainability by citing the human-rights and environmental implications of traditional diamond mining. Aether Diamonds is taking things a step further: its diamonds are made from carbon sucked from the atmosphere. Less expensive than mined diamonds but more costly than other lab-grown varieties, they're created with carbon dioxide air-capture technology. "Ultimately, every atom of carbon that lands in that diamond was previously warming the planet," says CEO Ryan Shearman. After eight to 12 weeks of chemical transformation (as well as cutting and polishing), they're ready to become part of a sparkly engagement ring. Aether also uses capital from its sales to help scale up the nascent carbon-capture industry.

—Eliza Brooke



Accessibility

A BIONIC FUTURE

Esper Hand

Capitalizing on advances in artificial intelligence and digital signal processing, Esper Bionics' prosthetic hand is the first AI-powered, cloud-based robotic prosthetic that gets smarter over time. The lightweight device has up to 24 wearable sensors that detect and process muscle activity and brain impulses; machine learning from Esper's platform enables the hand to act more "intuitively" over time. Esper Bionics CEO and co-founder Dima Gazda, a medical doctor and engineer, sees the prosthetic market as ripe for disruption—and setting the stage for a bionic future. "The most important technology developed in the next 30 years will be electronics inside the human body," he says.

—LESLIE DICKSTEIN

DIAMOND, HAND: SERGIY BARCHUK FOR TIME

Trend

Adapting to extreme heat

Many parts of the world this year experienced record temperatures as climate change became more apparent. Over the coming years, individuals, cities, and countries will be forced to adapt, and inventors are finding ways to help.

Chemicals and energy for traditional AC units exacerbate climate change, but the **Gradient** window air conditioner is powered by an emission- and energy-reducing heat pump. **InVert** self-shading windows reduce solar heat gain by blocking light when the sun is at its highest.

StreetBond's reflective coating is a paint for asphalt that keeps pavement cooler. And BMW has created the first color-changing vehicle—the **iX Flow**—that can turn darker or lighter to attract or reflect heat.

Agriculture is particularly at the mercy of higher temperatures. The **Climate AI** forecasting tool predicts conditions years in advance, allowing agribusinesses to plan effectively.

Heat-proofing utilities' infrastructure can help prevent power outages; **UrbanFootprint Grid Resilience Insights** uses data to allow governments and companies to make better decisions about where to prioritize upgrades, and **Gridware** is a network of sensors along power lines that alert the utility when they detect a problem.

With extreme temperatures come droughts, and **Epic Cleantec's OneWater** system treats and recycles wastewater for reuse in large-scale residential and commercial developments to reduce water use. The **Reva** showerhead by Oasense saves about 50% of the water used in a normal shower by reducing flow when you step out of the stream to lather, while **Kara Pure** uses the air's humidity to create potable water. —Jennifer Duggan

Transportation

AUTONOMOUS AERIAL REFUELING

Boeing MQ-25 Stingray

Midair refueling has been around for about a century. But late last year Boeing made history when its 51-ft.-long MQ-25 Stingray became the first autonomous aircraft to refuel an aircraft during flight. The U.S. Navy has been testing the system, and if all goes as planned, pilotless Stingrays will gas up entire fleets of fighter jets—thereby extending their range to about 1,000 miles—and enter regular military operations in 2026. The Navy plans on procuring 76 of the Boeing-made drones in total. “MQ-25s [are] going to be a game changer for war fighters,” says Troy Rutherford, Boeing MQ-25 vice president. —NIK POPLI

Automotive

FIGHTING SMOG

Power Global eZee Module

In India, home to 21 of the world's 30 most-polluted cities, many air pollutants come from the millions of auto rickshaws that navigate congested streets. So Power Global created the eZee Module, a subscription battery service for drivers who use cleaner electric rickshaws. Drivers receive a battery module, which they can swap when depleted for charged ones at a growing network of kiosks, for roughly \$2 to \$3 per day—a savings of at least 30% per day compared with diesel or petrol costs. “That’s a huge amount for someone making between \$8 and \$10 a day,” says Power Global founder and CEO Porter Harris. —MATT ALDERTON

Beauty

A VEGAN RED

Hourglass Confession Lipstick Red O

A classic red lip has long been out of reach for vegans, thanks to the makeup industry's reliance on carmine, a pigment made from crushed insects that until recently had been impossible to replicate. After three years of research, Unilever-owned vegan-cosmetics brand Hourglass came up with a patent-pending carmine alternative that achieves the same brilliant red. The resulting lipstick, Red O, delivers richly saturated color with a satin finish and comes in a sleek, refillable applicator. Hourglass plans to make its carmine-replicating process open-source in the near future. —CAITLIN PETREYCIK

Experimental

ONE TINY INCISION

Vicarious Surgical Robotic System

Vicarious Surgical's mission is to make surgeries safer. The company created a robotic system featuring a camera with 360-degree views: surgeons wear a VR headset while controlling the robot's two arms, each with 28 sensors for extreme precision. The starting point? A 1.5 cm (0.6 in.) incision through which the robot enters the patient's body.



“Complication rates from open surgeries are 15% to 20%, just from the incision,” says Vicarious Surgical CEO Adam Sachs. “By making incisions really small ... you can knock complication rates down to about 1%.” The company, which went public last year, is currently building its Beta 2 prototype with plans to introduce the \$1.2 million system to hospitals as early as 2024. —M.A.

BEST
Inventions
2022

Experimental

QUANTUM LEAP

ColdQuanta Albert

Albert may be the world's coolest cloud-based service—literally. The only quantum design platform of its kind, Albert lets anyone access and manipulate atoms cooled to a billionth of 1° above absolute zero, from their own computer. With this technology, once accessible only to professional scientists but now free to all, researchers can remotely use ColdQuanta's quantum-matter machine to design potentially transformative innovations. One possibility: autonomous vehicles that never lose their GPS signal. The beta version of Albert launched this year, with an official release coming soon. —NOVID PARSI

Beauty

Down the drain

Plus Body Wash Sheets

The personal-care and beauty industry has a big plastics problem. Plus pushes environmentally friendly toiletries beyond refillable bottles with its body-wash sheets that come wrapped in water-soluble sachets. Just open one and remove the dehydrated cleanser, wet it, and watch as it transforms into a moisturizing lather while the packaging dissolves down the drain. Or get the brand's roll holder and tear off a dissolvable sheet of body wash each shower. The body-wash sheets are available through the company's website and at Target's U.S. stores, making it the first mass-retail fully dissolvable, waterless body wash. —Caitlin Petreycik



Consumer Electronics

ALL-DAY HEADPHONES

Sony LinkBuds

Typically, situational-awareness earbuds employ a mic to artificially relay ambient sound. Sony's LinkBuds take another tack with a distinctive doughnut shape that allows external sound to directly enter the ear. These wireless earbuds avoid plugging the ear canal and offer a bevy of smart features: the option to tap next to your ear to control audio, adaptive volume adjustment for noisy environments, and auto-pausing when the wearer is speaking. For the 40% of Gen Z members who use headphones for five-plus hours every day, LinkBuds are a comfy option for seamlessly linking the digital and natural worlds. —ALISON VAN HOUTEN



Fitness

THE FIRST DOUBLE-FOLD TREADMILL

King Smith WalkingPad X21

Any fitness-conscious person living in tight quarters will appreciate the WalkingPad X21. It's the only treadmill that double folds into an ultra-flattened shape: the track folds 180 degrees and then nests under the handle, which contains an integrated panel display. Just under 9-in. thick when folded, it can fit underneath a bed or in a closet. Contrary to its name, you can run on the WalkingPad up to 7.4 m.p.h., a roughly 8-min.-mile pace. A KS Fit app tracks workouts and allows the user to change the speed, while the motor tops out at 75 decibels—about as loud as a vacuum cleaner—so runners and walkers alike won't disturb downstairs neighbors. —MARISA TAYLOR KARAS

Trend

Cutting-edge fun

Working toward a greener future doesn't mean you have to live a boring life. Innovation is making hobbies more climate-friendly—and more fun. **Taiga Motors' Orca** is the first mass-produced electric jet ski that reduces fuel costs and emissions. The electric-powered **Fliteboard** hydrofoils through water without any need for wind or waves. **Smith's I/O MAG Imprint 3D Goggles** give skiers a made-to-order custom set of goggles for a better fit, and **Zygo Solo** headphones let swimmers stream their favorite music or podcasts underwater.

For the indoor set, **Viture One** smart glasses put the movie theater or gaming screen right on your face, anywhere with a wi-fi connection, while **Samsung's The Freestyle** projector provides a large-screen clear-audio movie experience on any solid surface. Gaming innovations are more immersive than ever with products like **Skinetic**, a vest that pairs with VR technology to provide haptic sensations of the virtual world.

Social media app **BeReal** has changed the social media game from curated to, well, real, by prompting users to post whatever they're doing at a random time each day.

As a respite from screen time, audio has seen a resurgence, with a modern twist. The **Victrola Revolution Go** is a Bluetooth-enabled portable record player with a rechargeable battery. And **StoryPhones** let kids listen to classic children's stories or recordings of a loved one reading a story by inserting a disc into their comfy headphones. —Mariah Espada

Green Energy

PORTABLE DISASTER RESPONSE

Footprint Project Microgrids

When floods, hurricanes, and other climate disasters strike, it can take a long time to restore power. The Footprint Project, in partnership with Schneider Electric and Micro-soft, provides portable microgrids that produce electricity for personal, medical, and communication needs. From Hurricane Ida in Louisiana to tornadoes in Kentucky and earthquakes in Puerto Rico, microgrids have helped provide food, water, supplies, medical services, and equipment-charging capabilities to communities. Cloud-connected inverters enable remote—and more efficient—management of microgrid fleets, helping Footprint Project scale up. —JOE MULLICH

Consumer Electronics

AN EPIC STYLUS SMARTPHONE

Samsung Galaxy S22 Ultra

Think of the Galaxy S22 Ultra as a highly successful merger: it brings together the high-end photography and video chops of Samsung's S Series smartphones with the stylus central to the Galaxy Note line (now discontinued). Ultra-wide, telephoto, and selfie lenses take extra-crisp video and photos, even at night. With a stylus latency of just 2.8 milliseconds—70% better than the Galaxy S21—expect to emulate a pen-and-paper experience. (The stylus tucks inside the device for charging.) This is Samsung's flagship, with the beefed-up cameras, processor, and 6.8-in. display to prove it. The bar has officially been set higher for Android smartphones. —N.P.



Consumer Electronics

A mini microscope

QingYing E&T iMicro C Smartphone Microscope

This fingertip-size microscope—which weighs a half-gram (0.02 oz.) and easily attaches to any smartphone camera lens with a nano suction pad—magnifies small objects up to 200 times. According to Shanghai-based QingYing E&T, the microscope is ideal for “large micro” objects, like insects or gears inside watches. Photography enthusiasts and kids getting into science can enjoy a closer look at the world for a small fraction of the cost of a traditional microscope. An optional μRuler (microruler) measures micro objects and calibrates the scale bar in a companion app. —J.M.

Household

SIMPLE SOLAR

GAF Energy Timberline Solar Roof System

Even with rebates and tax credits, rack-mounted rooftop solar arrays are far from free. GAF Energy, a sister company of roofing giant GAF, has developed a low-cost solution: Timberline Solar, a rooftop system featuring solar “energy shingles” that can be installed by a roofer with a nail gun. The new product, certified as a roofing and solar product and warrantied for 25 years, could disrupt solar companies by giving homeowners the option to install a new roof and renewable-energy system at the same time—just hire a roofing company. —AMY GUNIA

Medical Care

SAFER MEDICAL TRAINING

GigXR HoloScenarios

Teaching medical students can be expensive and time-consuming—and, in the COVID-19 era, risky. The new application Holo-Scenarios, released in June, allows students wearing a mixed-reality headset to interact with holographic patients who have common respiratory conditions, including asthma, anaphylaxis, and pneumonia, and monitor how they react to treatments. Dr. Arun Gupta, a consultant at Cambridge University Hospitals who helped create the learning tool, says the program will expand access to training by allowing students to practice remotely. “The ability to simulate real-life responses allows you to train on more complex conditions—and also to fail safely,” Gupta says. —TARA LAW

Design

MAGNETIC MUSIC

Earshots Wireless Headphones

Earshots founder James Bell-Booth couldn't find headphones that stayed on while he was trail running or biking, so he came up with a solution: headphones with a magnetic “earlock” system that keeps wireless earbuds in place, no matter how strenuous the activity. Earshots allow in some ambient sound so that users can remain aware of their surroundings, and each earbud rotates up to 40 degrees to accommodate different ear shapes. What began as a Kickstarter campaign is now for sale globally.

—JENNIFER DUGGAN

BEST
Inventions
2022Entertainment & Gaming**SYNTHESIZING
NEW SOUNDS***Roli Seaboard Rise 2*

The instrument that brought the piano into the digital age just got its first upgrade in seven years. Roli's original Seaboard Rise keyboard replaced piano keys with pressure-responsive silicone "Keywaves," giving musicians the ability to bend and shape notes without knobs, faders, and pedals. The 25-key first iteration enabled the unique sounds of the hit TV show *Stranger Things* and platinum albums by Drake, Ed Sheeran, and others. The 49-key, four-octave Seaboard Rise 2 introduces guitar-inspired silicone "frets" to give users more control. "This change, along with other adjustments to the shape of the Seaboard's Keywaves, dramatically improves both the approachability and performance" of the instrument, says Roli's Danny Siger. —JARED LINDZON

Accessibility**DIGITAL BRAILLE***Polly*

When visually impaired children learn braille in a classroom, their teachers can let them know how they're doing. But many of those students don't have braille readers at home to help them. Now they can use Polly—a wi-fi-enabled device developed by American Printing House for the Blind and Thinkerbell Labs that provides braille learners with instant audio feedback and allows teachers to assign and assess homework remotely. Instead of a standard metal or plastic slate used with paper, learners can write (and correct mistakes) using Polly's electronic braille slate and stylus—the world's first. —NOVID PARSI

Social Good**EXPANDING
BROADBAND
ACCESS***Astranis MicroGEO*

It's easy to take broadband access for granted—unless you're one of the 3 billion people on the planet who lack it. In the developing world and elsewhere, fiber-optic service is too difficult to set up, leaving satellite connections as the only alternative. But satellite service is expensive, costing some subscribers up to \$300 per month. Astranis has a solution: an internet satellite just one-twentieth the size and cost of a traditional design that can be built five times as fast. The first MicroGEO satellite is slated to take orbit later this year to provide service across Alaska, where 30% of Indigenous people lack broadband; Astranis says the price will be half that of currently available service. In 2023 a second satellite will be launched, providing similar coverage to Peru. By 2030 Astranis plans to have a fleet of 100 satellites. —JEFFREY KLUGER

Trend**Powering a
greener future**

The world is facing an energy crisis, and the Russian invasion of Ukraine has created insecurity about energy supplies and surging gas prices.

To power transportation, sales of EVs are booming, and battery performance is improving. The **ABB Terra 360** electric-car charger claims to be the world's fastest EV charger, at 15 minutes for a full charge, while the **CATL Qilin** battery can take a car 620 miles on just one charge.

Environmentally friendly batteries will power the future, and Swiss national laboratory EMPA is developing a **water-activated disposable paper battery** for small electronics, reducing the need for mined materials. Meanwhile, self-charging products—like the **Samsung SolarCell Remote**, which is made from recycled materials—remove the need for disposable batteries.

Better energy storage is needed to power homes and businesses with renewables. **Nant de Drance's "hydro" battery** is an underground water-pump system in Switzerland that will store as much energy as a nuclear power plant. **Lavo's hydrogen battery** stores rooftop solar energy in a small unit for homes. There are new forms of energy too. **Oscilla Power's Triton** wave-energy converter (WEC) can generate power from all oceanic movements.

And smart technology is helping reduce energy costs. The **Square D Energy Center** is a modern breaker box that allows homeowners to switch between energy sources, while the **Ecobee Smart Thermostat Premium** provides a remote room sensor for managing energy use.

ICON House Zero—a 3D-printed home—reduces the use of construction material along with emissions and waste.

—Jennifer Duggan



Parenting

The smallest jogging stroller

Guava Roam Crossover Stroller

Dealing with bulky kids' gear can be one more obstacle to getting out the door—and jogging strollers are particularly unwieldy. Guava rose to the challenge with its Roam Crossover Stroller: its rear wheels collapse inward while folding forward toward the front wheel. The result? "A more portable stroller that collapses down to 50% smaller than traditional joggers on the market," founder and CEO Scott Crumrine says. Among the lightest jogging strollers out there (it weighs 25 lb.), Roam doesn't sacrifice stability or durability, with a smooth suspension system and all-terrain, airless tires that can't be punctured. Picking up the pace is as simple as flipping the handlebar switch from walk to run mode—no need to bend down by the front wheel. —Ashley Mateo

Beauty

OPTIMIZING SERUMS

Droplette Micro-Infuser

Droplette co-founders Madhavi Gavini and Rathi Srinivas knew that most of the topical serums people use on their face simply evaporate, and they set out to create a painless way to get more product under the skin. Their patented technology transforms water-based serums, such as collagen, glycolic acid, and retinol, into aerosols and then into tiny microdroplets that their research shows penetrate the skin's barrier 20 times as deep as topical creams. Gavini and Srinivas are now pursuing FDA approval to use the device to administer topical drugs for medical conditions like epidermolysis bullosa, a rare disease that causes blistering skin. —GUADALUPE GONZALEZ



Outdoors

ZERO-EMISSIONS SNOW FUN

Taiga Electric Snowmobile

The electric-vehicle revolution has officially reached the tundra: Quebec-based Taiga Motors is the first to sell fully battery-powered snowmobiles. "The snowmobile is among the hardest platforms to electrify because it operates in extreme cold temperatures," says CEO and co-founder Sam Bruneau. Taiga tackled that with an ultra-compact proprietary battery pack featuring built-in thermal systems. It will take you 62 miles (100 km), and an optional larger battery bumps the range up to 83 miles (133.5 km)—all with zero emissions. That's a big upgrade from two-stroke-engine snowmobiles, which are allowed to emit pollutants at much higher rates than cars. —J.L.

Food & Drink

FLASH-FROZEN COFFEE TO GO

Cometeer

Every day, two-thirds of Americans drink coffee—much of it "stale or poorly brewed," says Matthew Roberts, CEO and co-founder of Cometeer. Ground coffee beans begin losing their flavor within hours, Roberts says. His company's solution: a system that brews coffee 10 times stronger than a standard cup, then flash freezes it with liquid nitrogen to lock in peak taste for months. The frozen capsules (\$2 each), ranging from light single-origin Rwandan to dark-blend Ethiopian, pack nuanced complexity into recyclable aluminum capsules. Just dissolve in 8 oz. of hot water. —N.P.



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Accessibility

VIRTUALLY ACTIVE

RendeverFit

Early in the pandemic, when older Americans were physically isolated, Rendever CEO and co-founder Kyle Rand realized that virtual reality could help. In 2022, Rand's team launched RendeverFit, a VR platform that offers three activities: paddling (similar to ping-pong), cycling, and painting. Seniors wear headsets, hold controllers, and watch one another's progress on a leaderboard. "The last time I was at a community, we had staff from the kitchen bursting in, like, 'What are you all laughing about?'" Rand says. RendeverFit is now being used in more than 400 senior facilities.

—ANGELA HAUPT

Automotive

Vehicle vision

Aeva Aeries II 4D LiDAR

The Aeries II sensor system changes how vehicles see the world. Self-driving vehicles have traditionally used LiDAR—short for light detection and ranging—to map their surroundings and detect the objects moving around them. But traditional LiDAR sensors have limited speed-measurement precision. So Aeva developed Aeries II, which goes beyond mapping the 3D position of objects to instantly measuring the velocity of everything in a 120-degree field of vision. The whole system, now being integrated into leading software platforms for self-driving vehicles, fits on a single silicon chip. And CEO Soroush Salehian says distance is no problem: Aeva has also partnered with NASA to map the surface of the moon. —Julia Zorthian

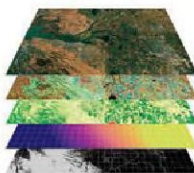


Sustainability

CLIMATE-FRIENDLY FARMING

Perennial Soil-Based Carbon-Removal Verification Platform

One hundred billion tons. That's how much CO₂ soil could remove from the atmosphere by 2100 with less tilling and other farming techniques. But that means transforming agricultural practices globally. "[We're establishing] an entire eco-system for farmers to get paid for not only producing food in a way that sustains the soil ... but also pulling carbon out of the air,"



says Oleksiy Zhuk, co-founder and president of Perennial. The platform analyzes the chemical composition of soil (currently in the U.S. and Australia) and provides standardized—and cheaper—data to help corporations achieve net-zero targets, while putting more offset dollars into farmers' pockets. —KI MAE HEUSSNER

Apps & Software

AD-FREE SEARCH

You.com

Google is the Goliath of search, and the latest David eager to bring it down is You.com. Unlike traditional search engines that provide lists of links, You.com summarizes web results using intuitive categories, without ad-sponsored results. The site has other useful elements—built-in apps, like Twitter search tools, let you complete tasks directly from the search page. Users can toggle to "private mode" to end all data collection, full stop, going further than both Google and Duck Duck Go. (Investors in You.com include TIME co-chairs and owners Marc and Lynne Benioff.)

—JOE MULLICH

Consumer Electronics

The future calls

Nothing Phone (1)

Carl Pei knew that going up against Samsung, Google, and Apple would require a smartphone that was like nothing anyone had seen before. “We are breaking into one of the most competitive industries in the world,” he says. After raising over \$200 million, Pei’s company, Nothing, released Phone (1) in July. With an iPhone-like design and custom version of Android OS, where Phone (1) really stands out is with its “glyph interface.” The device’s transparent backside allows 900 LEDs to create light patterns that sync with music, alerts, and vibrations. Glyph flashing patterns can be customized to, say, act as caller ID. It’s available in the U.K. and other parts of Europe, as well as India and Japan. Don’t expect it in the U.S. soon—it’s not FCC-certified.

—JARED LINDZON

Outdoors

COLOR- ENHANCING SUNGLASSES

Spy Optic Happy Boost Lens

These days sunglasses are capable of a lot more than just protecting your eyes and looking cool. For its Happy Boost line of sunglasses, released in June, Spy Optic leaned on AI to review millions of color combinations in search of a lens formula that could brighten colors—and the wearer’s mood, perhaps. The sunglasses protect eyes and reduce glare while enhancing color by 30% when compared with the naked eye, according to the company, going beyond what similar glasses offer. What does that mean in practice? For the athletic and outdoorsy, better visibility when trail biking or snowboarding. For the more casual user, a rosebush exploding with vivid red flowers, like an Instagram filter for real life. —ELIZA BROOKE

Automotive

SMARTER CARS

Qualcomm Snapdragon Digital Chassis

If you’re looking to buy a vehicle loaded with digital tech, odds are Qualcomm built the architecture for it. The company’s Snapdragon Digital Chassis—the software that runs the digital parts of the car, such as audio and displays, but also autonomous parking and navigation, and EV efficiency features—is being used in part by major automakers, including General Motors and BMW. A set of customizable, integrated platforms that are more advanced than any previous software, Digital Chassis is connected to the cloud nearly 100% of the time, processing information to enable automakers to create a safer experience. —NIK POPLI

NOTHING PHONE: SERGIY BARCHUK FOR TIME

BEST
Inventions
2022Beauty**HOME HAIR SALON***L'Oréal Colorsonic*

With inflation rates high, trips to the salon can feel indulgent. This new device makes dyeing hair at home less tricky, time-consuming, and messy. Colorsonic is a dye-dispensing wand with a nozzle brush that oscillates 300 times per minute to cover hair quickly and thoroughly, dispensing dye evenly to prevent dripping. A recyclable cartridge system keeps the dye and developer separate until it is turned on. Only when you're using the wand do the products mix to create the desired shade—40 will be offered—helping conserve dye. L'Oréal says it will go on sale by April 2023.

—GUADALUPE GONZALEZ

AR & VR**Powerful panoramas***Kandao Obsidian Pro*

Livestreaming has made events like stadium-scale games or NASA rocket launches more accessible to people around the world. But the 360-degree cameras currently used still struggle with limited resolution. The Obsidian Pro is the first panoramic video camera to shoot in 12K, as well as the first with electronically adjustable aperture and focal length. With eight spider-like lenses combining to deliver immersive VR-ready footage, the professional-grade Obsidian Pro is quickly becoming the new standard for filming or livestreaming every angle of global events. —Alison Van Houten

Toys & Play**A BEAR THAT HUGS BACK***Hugimals*

As weighted blankets gained popularity in recent years, Hugimals founder Marina Khidekel saw an opportunity for a more portable product to provide comfort “anytime you need a calming hug.” Developed in consultation with therapists, psychologists, and pediatricians, Hugimals are weighted stuffed animals that feature a glass-bead filling to give the sensation of being hugged. The company partnered with the Toy Foundation to make Hugimals available to patients in five children's hospitals; one 9-year-old tester reported feeling “safer” snuggling with one. Hugimals has also seen orders from educators who use them in schools “to help kids manage big emotions and stay focused,” Khidekel says. —JENNIFER DUGGAN

Consumer Electronics**THE SMALLEST CHIP EVER***IBM 2-Nanometer Chip*

IBM's 2-nanometer (nm) chip technology puts 50 billion transistors, each the size of roughly five atoms, on a space no bigger than your fingernail. The landmark technology—the smallest, most powerful microchip ever developed—could quadruple the life of cell-phone batteries and slash the carbon footprint of data centers, among other things. Now the manufacturing competition is on. Samsung and the Taiwan Semiconductor Manufacturing Co. have announced plans to produce the chip by 2025, and in August, the U.S. and Japan unveiled a plan to build a joint research center focused on 2-nm tech. —JOE MULLICH

KANDAO: SERGIY BARCHUK FOR TIME

Trend**Exploring the world(s)**

Great inventions have always powered exploration. This year's standout example is **NASA's James Webb Space Telescope**, the most powerful telescope ever built. The agency's **Space Launch System** will also soon send the largest-ever rocket skyward, setting the stage for new missions to the moon, Mars, and beyond. And **Astrobot's Peregrine Lunar Lander**, also set to launch by the end of this year, will prove whether the private sector can reach the moon.

Back on Earth, Advanced Navigation's autonomous underwater vehicle **HydruS**—just 15 lb.—makes deep-sea exploration accessible to amateurs. On land, **Exodigo's subsurface mapping platform** produces detailed 3D maps of underground terrain. And **Lyra**, a small robot with radiation detectors and an arm to take swab samples, was designed to explore radioactive nuclear complexes.

The newest frontiers for exploration, of course, are digital worlds. Many will emerge from **Epic Games' Unreal Engine 5**, which over 100 video-game studios are now using to create lifelike worlds. **Tripp's VR wellness platform** combines immersive kaleidoscopic imagery and guided meditations to shift moods and calm minds.

Meanwhile, the metaverse is emerging: **Magnopus' Connected Spaces** allows anyone to create and explore interactive virtual 3D spaces using a range of devices. And in South Korea, Seoul's government this year launched **Metaverse Seoul**, a virtual civic space featuring a city hall and a public plaza.

—Jeremy Gantz



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one of the fuels
of the future?

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This question powered one of our most ambitious pilot projects to date – a supply network demonstration covering the complete hydrocarbon value chain, including the conversion of hydrogen to blue ammonia for safe and cost-effective shipping. In 2020, in partnership with the Institute of Energy Economics Japan and our subsidiary SABIC, we successfully shipped forty tons of blue ammonia to Japan for various cleaner-power generation applications.

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Formula 1 is at the forefront of technology. By partnering with Aston Martin Formula One Team, we're driving the development of more efficient engines, advanced fuels, lubricants and non-metallic materials. Innovations that one day, could increase performance and reduce emissions for cars everywhere.

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how

can today's
resources fuel our
shared tomorrow?

The world's communities and economies continue to grow, and so does their demand for energy. But our resources aren't limitless.

This challenge powered the development of best-in-class exploration practices, advanced modelling techniques and computational science to maximize reservoir yield. Thanks to our pioneering simulation technologies, we have the insights to optimize production efficiency across all our reserves.

Discover how we're meeting growing global demand while planning for the future at aramco.com/poweredbyhow

Experimental**NEXT-GEN HOLOGRAMS***Light Field Lab SolidLight*

There are two types of innovations: ones you see coming and ones that blow your mind. Light Field Lab's SolidLight modular holographic system is the latter. Most holograms today use a variation of Pepper's ghost, a technique that makes 3D illusions from 2D images. With SolidLight, however, "it's not an illusion—we're actually re-creating" 3D objects, says Jon Karafin, Light Field Lab's co-founder and CEO. SolidLight holograms protrude into mid-air and behave, visually speaking, like the physical objects they're meant to embody. The modular video-panel design means potential applications are wide-ranging: anything from a single 28-in. panel of NFT art to a 224-in. 3D advertisement wall in a store. —GUADALUPE GONZALEZ

Fitness**A SWIM CAP FOR TEXTURED HAIR***Soul Cap*

After taking up swimming as adults, Soul Cap co-founders Michael Chapman and Toks Ahmed-Salawudeen realized that existing swim caps weren't designed for Black swimmers like themselves, who need extra protection from the effects of chlorine and a larger design to accommodate thicker, curlier hair. Their solution: the Soul Cap, which can cover dreadlocks and braids, and aims to make the sport more inclusive. But swimming's international federation, FINA, banned the caps ahead of the Tokyo Olympic Games, saying they did not conform to "the natural form of the head." In September, after an outcry, FINA reversed its policy. The silicone cap earned a partnership with Adidas the same month. —ALICE PARK

Consumer Electronics**Lossless earbuds***NuraTrue Pro*

The first truly wireless earbuds to support lossless audio quality over Bluetooth, the NuraTrue Pros are a step forward for the audiophile set. Designed to handle a new compression technique that enables CD-quality audio to be streamed, these earbuds are for people who want to pair mobility and uncompromised sound. (Apple Music currently offers lossless streaming, while Spotify has plans to roll out this feature.) But the NuraTrue Pro system offers more than that: it personalizes sound by creating a custom EQ profile after measuring how each of your inner ears responds. Luke Campbell—the Australian ear, nose, and throat surgeon who co-founded Nura—wonders why most headphones treat everyone the same, even though no one hears exactly alike. —Kalen Goodluck

Entertainment & Gaming**GAMING MARATHON***HyperX Cloud Alpha*

The Cloud Alpha headset for PC gamers shows just how energy-efficient a consumer device can be. It lasts 300 hours between charges—multiple times the duration of competitors. "The design philosophy was, How do we get the most power out of a battery for the longest period of time?" says Daniel Kelley, head of global marketing at HP-owned HyperX. The headset uses an ultra-low-energy transceiver, audio codec, and chips that sip power sparingly from a 1,500-millamp battery. It also has supercushy ear pads, important for extended sessions. —DON STEINBERG

Green Energy**A MINI NUCLEAR REACTOR***NuScale Power Module*

Shrinking reactors makes nuclear power safer, more scalable, and less costly. That's the idea behind the NuScale Power Module, the first and only small modular reactor (SMR) to receive design approval from the U.S. Nuclear Regulatory Commission. Instead of the traditional concrete-domed plant, each NuScale module consists of a 76-ft.-tall, 15-ft.-diameter cylindrical reactor and containment vessel sitting in a steel-lined, water-filled pool belowground. The SMRs automatically shut down and self-cool in the event of power failure, and each generates about 77 megawatts of electricity, enough to power 60,000 homes. The company's first power plant could be running by 2029 in Idaho. —JILLIAN MOCK

Household**GREEN THUMB NOT REQUIRED***LG Tiun*

Gardening usually demands skill and patience. But if you live in South Korea, all you need is an LG Tiun. Named using the Korean verb for *sprout*, the indoor-gardening appliance from LG Electronics looks like a mini-fridge but acts like a super-smart tiny greenhouse. It has automated weather, water, and lighting controls to maintain optimal plant growth, and users can adjust settings at any time through a companion app. LG Tiun is available only in South Korea, but the company says it is "currently seeking opportunities" in other markets. —G.G.



**BEST
Inventions
2022**

AR & VR

SIMPLIFYING VR

*Canon RF5.2mm F2.8 L
Dual Fisheye Lens*

Despite its name, the Dual Fisheye lens was actually inspired by the human face. Featuring two round lenses about the same size and distance apart as a pair of human eyes, the first-of-its-kind lens captures 180 degrees in 8K-equivalent resolution when mounted to Canon's EOS R5 and EOS R5c mirrorless cameras. According to Canon USA's Brandon Chin, the compact, award-winning lens simplifies 3D image capture by eliminating the need to stitch together multiple images from multiple cameras, putting high-end VR content creation within reach for more visual artists.



Household

A BATH THAT DRAWS ITSELF

Kohler PerfectFill

Your fridge and your thermostat are smart—why not your bathtub too? Kohler created PerfectFill, a system with a digital valve, a smart drain, and an app that can draw a bath with the click of a button (or a voice command when paired with Google Assistant or Alexa). PerfectFill controls the bath's depth and temperature, and can remember up to 10 presets—shortcuts to users' exact preferences—so you can draw a warm, shallow bath for the kids after dinner and a hot, deep one for yourself after they're in bed. Compatible with Kohler tubs, the system requires professional installation (some components need to go behind a wall). PerfectFill is expected to go on sale by early 2023.

—GUADALUPE GONZALEZ



Outdoors

Portable filtration

LARQ Bottle Filtered

Somewhere around 500 billion plastic drink bottles are sold each year worldwide, and over 91% of consumer plastic is not recycled. Nonplastic reusable water bottles are indisputably best for the environment, but when you're in the great outdoors, it's hard to find clean water to refill them. The LARQ Bottle Filtered has a filtration system in a portable water bottle that is comparable to bigger home systems in the level of filtration. It filters as the drinker sips, removing lead and other heavy metals, pesticides, and PFAS, the so-called forever chemicals that are linked to certain cancers. That can make hikers and travelers more confident about filling up at public taps instead of carrying prebottled water. An optional PureVis cap uses UV light to kill bacteria and contaminants in the water. —Don Steinberg



Design

DEFYING GRAVITY

Novium Hoverpen 2.0

Sitting between utility and magic, the Hoverpen 2.0 is a ballpoint pen that hovers at a 23.5-degree angle—a nod to the earth's axial tilt—without electricity. The feat is achieved thanks to physics, gravity, and a proprietary formulation of neodymium magnets. David Liang—the physicist who co-founded Novium, the Taiwanese company behind the pen—says he wanted to create a “fascinating installation art piece” (from aircraft-grade aluminum) that could inspire. Hoverpen 3.0, which converts into a fountain pen, is in the works. —G.G.

LARQ, NOVUM: SERGIY BARCHUK FOR TIME; METHANESAT: BALL AEROSPACE

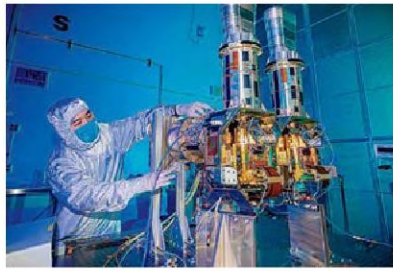
Trend

Improving AI

Fears of superintelligence notwithstanding, artificial intelligence (AI) advancements are powering an array of new inventions on a road or in a hospital or a home near you. **Gatik's driverless box trucks** are now making fixed-route deliveries to retail stores, shoring up supply chains in a tight labor market. Car-rental agencies have long inspected vehicles by hand for damage, but drawing on a database of 2 billion images, **Ravin's Inspect app** automates this process. 3D rendering is also time-consuming, but **Nvidia's NeRF tool**, built around a new AI-based technology called neural radiance fields, makes it faster, easier, and more accessible. And AI is supporting rapid-response humanitarian efforts in Ukraine: **Scale AI's automated damage identification tool** analyzes reams of satellite imagery to help target aid to bombarded areas.

On the home front, the AI-powered "personal sidekick" **ElliQ** robot chats with the elderly to help them overcome loneliness and isolation. The **Roborock S7 MaxV Ultra** cleaning robot uses AI to better navigate rooms while vacuuming and mopping. And the **Bambu Lab X1** 3D printer automatically fine-tunes its multicolor creations using AI. In hospitals, **Clinomic's Mona**, a bedside device for ICUs now used in Europe, uses speech recognition to support clinicians—no need to type up patient observations and treatments.

AI's ability to push science forward is underscored by **DeepMind's AlphaFold**, a new machine-learning program that has predicted the structure of nearly every protein known to humankind (about 200 million). Finally, **DALL-E 2** proves AI can also entertain: type a random nonsensical phrase into the online art generator—say, "deep space astronaut riding horse"—and prepare to smile. —*Jeremy Gantz*

Sustainability

TRACKING METHANE LEAKS

MethaneSAT

Carbon dioxide is the most common greenhouse gas, but close behind is methane, which is more than 25 times as potent as CO₂ at trapping heat. Tracking the exact source of methane emissions, most of which are caused by accidental leakage during fossil-fuel production, is challenging. **MethaneSAT**, slated to be launched into orbit by the Environmental Defense Fund in early 2023, will help. The \$90 million satellite, the first to be launched by an independent non-profit, will circle the earth every 90 minutes, using infrared imaging to spot methane leaks. Data on trouble spots can then be reported to companies, spurring corrective action. —*JEFFREY KLUGER*

Medical Care

CONTINUOUS STROKE MONITORING

Neuralert

Every 40 seconds, someone in the U.S. has a stroke. Early treatment is key to minimize adverse outcomes, yet a recent study of in-hospital strokes found that most go undetected for over four hours. Enter **Neuralert**, which the FDA designated a breakthrough device last year. The pair of smart wristbands use a proprietary algorithm to track arm asymmetry or weakness—common symptoms of stroke. **Neuralert** can detect symptoms in as little as 15 minutes, and automatically alert medical staff to spring into action. The company is targeting commercial release in 2023. —*G.G.*

Social Good

SEWAGE SURVEILLANCE

Biobot Analytics Wastewater Monitoring Platform

The COVID-19 pandemic mainstreamed wastewater-based epidemiology, which analyzes sewage to detect disease outbreaks. **Biobot Analytics** can identify current community levels of disease and opioid use from just 150 ml of an aggregate sewage sample from a 24-hour period. Because samples include everyone in a sewage system, "there's an incredible amount of intelligence in wastewater," says Newsha Ghaeli, Biobot's president and co-founder. The company is the first to commercialize data from sewage. The CDC in September expanded Biobot's contract to include monkeypox monitoring. —*J.G.*

Consumer Electronics

3D WITHOUT GLASSES

Acer ConceptD 7 SpatialLabs Edition

Acer's **SpatialLabs** unit has adapted lenticular technology—the kind that lets tacky picture postcards switch between images to simulate motion—to give users of this laptop a unique visualization machine. Geared toward designers and developers, the laptop can take models developed in 3D computer-graphics software and make them appear to thrust forward from the 15.6-in. screen—no glasses required. Face-tracking cameras let the computer show a slightly offset image to each eye. "It takes a second to adjust to the user in front of it, but then the image pops to life, and their eyes widen," Acer's Eric Ackerson says. —*D.S.*



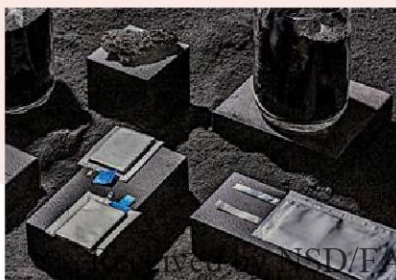
BEST
Inventions
2022Fitness**GYM IN A BOX***Tempo Move*

Home gyms are a great way to exercise regularly, but they tend to be expensive, unsightly, and large. Tempo Move is a smart fitness system that includes dumbbells, 50 lb. of weights, a subscription to thousands of workout videos and live classes, one-on-one coaching, and an elegantly designed compact cabinet for storage—all for \$59 each month. The AI sensor-driven system recognizes Tempo weights, giving feedback on users' rep speed and form. For now, it's compatible only with the iPhone XR or newer iPhone models, which send workout content to your TV. But the company is working to add Android compatibility as soon as next year.

—GUADALUPE GONZALEZ

Green Energy**Quick charge***Group14 SCC55*

Better batteries are critical for a greener future. This new silicon-carbon composite material from Group14 can improve the energy density and charging time of the batteries in everything from smartphones to EVs to earbuds. SCC55 can easily integrate into existing lithium-ion battery manufacturing processes, replacing the graphite now typically found in battery anodes. The result improves energy density by up to 50%, says Group14 CEO and co-founder Rick Luebke. SCC55 also enables extremely fast charging, so EVs could potentially charge in 10 minutes. The startup has several high-profile partners, including Porsche (an investor), which expects SCC55 to power its EVs in 2024. —Jillian Mock

Productivity**INCLUSIVE CREDIT BUILDING***Altro*

Two months shy of his freshman year and \$10,000 short of tuition, Michael Broughton kept being denied for loans. Many young people find themselves similarly stuck, he says: "It's hard to get your first financial product if you've never had one." So Broughton developed a free app that allows users to build a credit history and credit score via common small recurring subscription payments they may already make: Netflix, Hulu, Spotify, you name it. "We let people take control of their creditworthiness," says Broughton. The company, which is the only such credit-building app that works with all three major credit bureaus, has raised about \$21 million from investors, including Jay-Z's Marcy Venture Partners. —NOVID PARSI

Design**FUTURE SCHOOL***Ehrman Crest Elementary/Middle School*

Ehrman Crest Elementary/Middle School near Pittsburgh aims to show how physical spaces can impact educational outcomes. The \$63 million K-6 school, which opened in August, features harmonic walls that educate about sound, fractions, and energy; graphic walls with animals and numbers; and magnetic walls that let kids study local ecology. If it sounds like a children's museum, it is: CannonDesign and the Children's Museum of Pittsburgh partnered on the project. With security features like an art wing that doubles as a storm shelter, Ehrman Crest models the future of educational institutions. —JOE MULLICH

Trend**Foods of the future**

Technology is helping food become healthier, more sustainable, and more convenient to prepare. Amid labor shortages in the food industry, robots may have a role to play. Like **Flippy 2**, a robotic fry cook that automates safely frying fast food to perfection. Or the **LG CLOi ServeBot**, the first commercial robot server.

Unox Speed-X High Speed Oven can cook 10 dishes at different temperatures at the same time, preparing a whole chicken in just seven minutes. But the **Graphene Kitchen Styler** might be the most experimental kitchen innovation: graphene, a nano-material made from a single layer of carbon atoms bonded together, heats incredibly quickly; it can function as an oven or a grill when folded, a two-burner stove top when open, or a warming plate.

With sustainability top of mind for consumers, meat alternatives continue to rise. Beyond Meat's chopped-steak alternative, **Beyond Steak**, has the fibrous texture of real steak. **MyForest Foods' MyBacon** is made from nearly 100% mushroom root, with the texture and gristle of real bacon.

Atarraya's Shrimbbox provides a more ecologically friendly way to produce shrimp by growing the crustaceans in a high-tech converted shipping container system, while **Small Robot's Tom, Dick, and Harry** farm robots map, plant, or weed crops to help reduce the use of herbicides and fertilizers.

Atomo Coffee Molecular Cold Brew, a coffee alternative made from upcycled date seeds soaked in grape extract, chicory, and other flavors, emits 93% less carbon than regular coffee production.

And losing burrito fillings down your shirt could be a thing of the past with **Tastee Tape**—an edible, clear, and tasteless tape that holds food together. —Jennifer Duggan



Beauty

6-in-1 facial tool

Therabody TheraFace Pro

Until this year, none of Therabody's famous massage products were meant for use "from the Adam's apple up," as the company's co-founder and chief wellness officer Jason Wersland puts it. TheraFace Pro changes that, offering percussive therapy for treating tension around the jaw and sinuses. But it's more than just a gentle Theragun. It also functions as a portable skin spa, with six rejuvenating magnetized attachments, including a microcurrent head designed to lift and tone your facial muscles, a cone for targeting tightness in your mandibular joint, a red light ring for treating fine lines, and a soft rubber-bristle brush that Wersland recommends "running up and down your head after a long day." —Caitlin Petreycik

Entertainment & Gaming

OLD MADE NEW

Analogue Pocket

Analogue Pocket is an ode to Game Boy that looks like the classic Nintendo handheld console that reigned in the 1990s—but it's packed with modern features and higher resolution. Compatible with 2,780+ Game Boy Original, Color, and Advance cartridges, it also has cartridge adapters for Sega's Game Gear, Atari Lynx, and other old-school handheld systems. There's even a dock to connect it to a TV and up to four controllers, and a music synthesizer if you tire of games. —JARED LINDZON



Household

LEAK DETECTOR

Kohler H2Wise+

That leaky toilet may not seem like a big deal, but according to water-sensor maker Phyn, wasted water from one faulty toilet flapper could fill a 30,000-gal. swimming pool in just one month. That's why Kohler and Phyn teamed up to create H2Wise+, which tracks usage patterns, alerts homeowners to leaks, and automatically shuts off water in emergencies. Installed on main water lines, it blends cutting-edge sensors with machine-learning technology. By measuring changes in pressure 240 times every second, Phyn CEO Ryan Kim says, it can match a specific "fingerprint" to each water fixture in a home. That helps you save money while conserving an increasingly precious resource. —KI MAE HEUSSNER

Medical Care

PERSONALIZED BREAST-CANCER CARE

*Reveal Genomics
HER2DX Test*

This new test is designed for patients diagnosed with early-stage HER2-positive breast cancer, which accounts for about 20% of all breast-cancer diagnoses. (Onco-type DX tests, which have been around for years, target the 80% that are HER2-negative.) HER2DX analyzes 27 genes and clinical features to predict the effectiveness of treatment options and the risk of recurrence. The test could improve outcomes for early-stage patients, but it could also lead to more-personalized approaches for late-stage breast cancers. "This opens new opportunities," says Aleix Prat, chief scientific officer of Reveal Genomics. For now, the test is available to clinicians worldwide but must be processed in a Spanish lab. —K.M.H.

BEST
Inventions
2022Household**SMART WATERING***OtO Lawn*

Maintaining a verdant lawn typically requires a lot of time, money, or both. With OtO Lawn, “all you need is a good-quality garden hose and a strong wi-fi connection,” says founder and CEO Ali Sabti. Staked to the ground or mounted on a fence, OtO Lawn’s solar-powered, long-range 360-degree nozzle delivers water, fertilizer, and pest-repelling solutions to every inch of green space. App-controlled smart features let you program custom irrigation zones and integrate real-time weather data to automatically deliver the right amount of water, reducing consumption by up to 50%. —JARED LINDZON

Fitness**Tough meets lightweight***Merrell MTL Long Sky 2*

Merrell’s MTL Long Sky 2 is a case study in doing more with less. Created by the incubator-like Merrell Test Lab and released in July, the design of this performance trail-running shoe was inspired by Dutch trail-running champion Ragna Debats. Merrell is great at making heavy, tough “rhinoceros shoes,” Debats told the team—but she wanted cheetah shoes. “How do we take things out of the shoe while maintaining durability?” thought Merrell product-line manager Jon Sanregret. The Long Sky 2 offers efficient water drainage and strong traction, while reducing weight by about 10% with a revamped protective rock plate and lightweight foam material. It’s the lightest shoe that can easily handle highly technical terrain. —Eliza Brooke

Fitness**LIFT WITHOUT A SPOTTER***Vitruvian Trainer+*

Turn any space into a weight room with Vitruvian Trainer+, a smart, floor-based fitness machine that uses electromagnets to generate up to 440 lb. of resistance. With a multi-directional cable system and specialty attachments (such as a bar) capable of more than 100 exercises, “you just step onto it, lift cables, and enter a world of adaptive resistance,” says founder Jon Gregory. Whether you’re following a trainer-led class or your own workout program in the companion app, the machine’s algorithm is able to decrease resistance if you’re not reaching full range of motion in a specific exercise or add on load if you’re flying through reps—helping you stay safe while making gains at home. Postworkout, store it flat and out of sight. —ASHLEY MATEO

Social Good**SECURING PROPERTY TITLES***Colombia National Land Registry*

In a 2016 peace agreement ending Colombia’s long-running conflict, the government promised to formalize property titles that could prevent ownership disputes and help farmers get loans and invest in land. This year, the Colombian government’s National Land Agency launched a national land registry on the blockchain, a decentralized digital ledger of transactions that supports transparency and security. Developed with software developer Peersyst and blockchain company Ripple Labs, the registry recorded its first property in July, just a few weeks before a new administration took over the national government. While the project appears to have stalled, it remains a unique example of blockchain’s potential value in the public realm. —KALEN GOODLUCK



Design

Eye-catching sound

Lumio Teno

Creating a piece of technology that is also an objet d'art is no easy feat, but this portable, USB-charged light and Bluetooth speaker pulls it off. Inspired by the Japanese art of *kintsugi*—repairing broken pottery with lacquer mixed with precious metal—Teno resembles a stone bowl with a golden crack running through it; pull it apart, and light and sound pour out. Made of cast resin and sand, Teno has no buttons. Just tap it to adjust light and sound intensity (a single 45-mm, full-range driver should cover a medium-size room). When the battery gets low, there's no beeping—you'll hear the sound of raindrops. —Caitlin Petreycik

Wellness

A WEARABLE FOR WOMEN

Bellabeat Ivy

As fitness trackers gained popularity, Bellabeat's founders noticed many didn't cater to women's bodies. Bellabeat Ivy, the first health tracker engineered specifically for women, looks more like a bracelet than tech. The diamond-shaped device, which has no display, tracks menstrual cycles, fertility, and menopause symptoms, as well as heart rate, hydration, sleep, and other activities. And the companion app's algorithms take into account life-stage factors such as pregnancy and menopause when processing health data. That helps a "Bellabeat coach" make personalized recommendations to help users target goals such as losing weight or becoming stronger. —JULIA ZORTHIAN

Parenting

ON-THE-GO BOTTLE WARMER

BisbeeBaby Keddle

Parents with babies often feel captive to their little ones' appetites. The difficulty of warming breast milk or formula while out and about can make parents hesitant to stray far from home. BisbeeBaby Keddle—a portable, rechargeable bottle warmer—can heat up bottles (or breast-milk bags) within two minutes, fast enough to satisfy the most irascible infant. Temperature sensors throughout the device ensure the liquid is warmed evenly and accurately. And once a child grows into solid foods, the Keddle is still useful: try warming hot chocolate or instant coffee on a camping trip. —JOE MULLICH



MERRELL, LUMIO: SERGIY BARCHUK FOR TIME; COURTESY KEDDLE

**BEST
Inventions
2022**

Productivity

SAVE NOW BUY LATER

Accrue Savings

With interest rates rising, saving makes more sense. Fintech startup Accrue Savings flips the script on “buy now, pay later,” encouraging people to save now with a new kind of layaway for the digital-banking era. “I believe that brands have a responsibility to be sustainable and not just push credit down the throats of the public,” says founder and CEO Michael Hershfield. Customers set up a free (FDIC-insured) savings account and make auto-deposits toward a specific purchase goal. (Think: saving up for a couch.) Progress is rewarded with cash given out by participating merchants—currently 35, including brands like SmileDirectClub, Eterneva, and Casper. —GUADALUPE GONZALEZ

Robotics

MOBILITY ASSISTANT

Enhanced Robotics Sportsmate 5

Until now, you’d be hard-pressed to find an exoskeleton outside hospitals or rehab facilities. But after trying to create a more affordable device for outpatients, Enhanced Robotics unveiled a new way to level up workouts. The Sportsmate 5, which is worn around the waist and braces the thighs, provides assistance or resistance during activity with the touch of a button. “People move by producing torque, or force, at our joints,” CEO Hanqi Leon Zhu says. “Our algorithms can detect your gait and produce the torque needed to more easily achieve that motion,” reducing pressure and energy spent. On the flip side, athletes can use the exoskeleton, available in January 2023, to generate more force to train against, maximizing gains in the gym. —ASHLEY MATEO



Outdoors

A sleeker, safer helmet

KAV Portola Helmet

This sleek helmet makes an argument that safety and custom-fit comfort can go hand in hand. In April, the Silicon Valley-based brand KAV Sports launched its Portola helmet, boasting that it exceeds U.S. helmet protection standards by 25%. Each helmet is custom-3D-printed—the \$320 price tag includes a “fit kit” and a virtual fit session—with a carbon-fiber composite, a low-profile “antimushroom” silhouette, and an impact-efficient honeycomb structure inspired by aerospace engineering. “We founded the company with the mission of saving lives, and recognized very early on that in order to do that, we had to have a product that not only looked better but felt amazing on your head,” KAV Sports CEO Whitman Kwok says. —Eliza Brooke



Household

RECYCLED PAINT

Up Paint

About 10% of paint bought in the U.S. each year is wasted—and it all adds up to an astonishing 64 million gal., some of which is disposed of improperly, polluting the environment. Up Paint is on a mission to recycle unused material, working with PaintCare—a nonprofit that’s created a system of drop-off sites in 10 states for old paint—to collect, process, and tint leftover paint until it’s brought back up to retail standard. Over 90% of what comes into its facilities gets a second life. “Our main goal is to make a good everyday latex paint that can be used for interiors or exteriors,” founder Dustin Martin says. So far, the company offers 18 colors, with more launching in spring 2023. —CAITLIN PETREYCIK

KAV: SERGIY BARCHUK FOR TIME

Trend

Medical breakthroughs

Over the past three years, medical attention has been focused on developing tools to combat COVID-19 and, more recently, monkeypox. For immunocompromised individuals, **Evusheld COVID-19 Antibody Therapy** has provided some protection for those who are not able to be vaccinated, while antiviral drug **Paxlovid** minimizes symptoms.

When monkeypox emerged, Siga Technologies' **TPOXX (Tecovirimat)**, a smallpox drug, became a crucial treatment, while Bavarian Nordic's **Jynneos Vaccine** is being rolled out to prevent it from spreading. In outbreak situations, **Gama Healthcare Rediroom** is a portable room where infected patients can be safely isolated.

But some of the most exciting health care inventions go beyond virus treatment to widen access to imaging and monitoring. **Bio-adhesive Ultrasound** is a stamp-size reusable ultrasound sticker that continuously monitors internal organs. The **XX300 Autonomous Health Monitoring Solution** can remotely monitor vital signs, which helps minimize exposure to contagious patients.

Wearables have become a popular way to monitor vital signs, but **Biotricity Bioheart** takes it a step further and provides detailed data that could help inform cardiologists' diagnoses.

Advances in cancer treatment include **Molli Breast Cancer Localization System**, a tiny 3.2-mm magnetic marking device that is inserted under the skin to pinpoint the exact tissue for removal, and the **Galleri Cancer Test**, which screens for more than 50 types of cancers.

—Angela Haupt

Automotive

NEXT-LEVEL EV

Lucid Air

This sedan is more proof that electric vehicles (EVs) are getting better every year. Unveiled in late 2021 after years of development, the Lucid Air in many ways beats Tesla at its own luxurious EV game. It has the highest EPA-estimated range (520 miles) of any EV currently for sale but offers much more than a big battery: 1,200 max horsepower that can accelerate from 0 to 60 m.p.h. in less than two seconds; the ability to charge 300 miles in just 22 minutes; and a 21-speaker Dolby surround-sound system. With an electric power train designed and developed in-house, Lucid Air is the most efficient large electric sedan sold in the U.S., edging out offerings from Tesla, Porsche, Audi, and Mercedes. Not a bad first try from a company that's clearly going places.

—KALEN GOODLUCK

Style

WATCH ME GO

ObserveMÉ Watch Opening Apparel

Karen Fultz-Robinson encountered a persistent annoyance while training for a marathon: having to constantly adjust her long sleeves to check her sport watch. "It just takes the momentum out of the run," says Fultz-Robinson. Her solution? A special sleeve opening for the face of a watch, a design feature that became the basis of her active-wear brand, ObserveMÉ. The company now offers a full athletic line with the brand's signature watch opening (available for righties and lefties). Sometimes achieving big athletic goals is all about removing the small obstacles. —E.B.

Toys & Play

SMART SPEAKER FOR KIDS

Jooki

How many times a day does your child ask you to play "We Don't Talk About Bruno"? Give them control over the music with Jooki, a wi-fi- and Bluetooth-enabled speaker that lets children 3 and up stream songs and other parent-curated audio content. Via the Jooki app, parents can pair preapproved Spotify playlists and audiobooks (as well as downloaded MP3 files) to Jooki tokens and figurines, which little ones plug in to the device to start, stop, and pause a listening experience. And, yes, this device is durable enough to survive "Baby Shark" dance parties. The best part: the second iteration of the device connects to wireless headphones. —A.M.

Consumer Electronics

MORE THAN A FOLDABLE SCREEN

Asus Zenbook 17 Fold OLED

For its new Zenbook 17 Fold OLED—featuring the world's largest foldable screen yet, with a 17.3-in. touch display—Asus spent years developing hardware, including a new hinge system. The company has a line of Zenbook laptops, but this shape-shifting device is much more than that. Its range of modes is impressive: tablet mode, reader mode (fold it vertically, like a book), laptop mode (with a virtual on-screen keyboard), or desktop mode. For that last one, you prop the screen horizontally and use the detachable Bluetooth keyboard. It's slated for release by the end of 2022. —G.G.



BEST
Inventions
2022Parenting**A COMFORTABLE BREAST PUMP***Babyation The Pump*

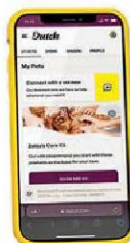
Pumping breast milk is mostly unpleasant. A bulky, noisy machine with two hard plastic flanges fiercely pulls at the nipples. “Nipples don’t look like udders,” says Samantha Rudolph, co-founder and CEO of Babyation. The Pump’s patented suction technology mimics how babies suckle, which she says is gentler than traditional breast pumps. The FDA-approved device includes soft silicone breast shields, a discreet tubing system, a quiet motor, and bottles—all in a carrying case with cooling to preserve milk. An app lets you customize pump settings, view pumping history, and more. —GUADALUPE GONZALEZ

Style**Read in the sun***DeepOptics 32°N Adaptive Focus Sunglasses*

DeepOptics originally wanted to make goggles for 3D television. But when the founders realized that more people have aging eyes than 3D TVs, they decided to use their vision tech to help people over 45 see both close and far, outside and in. Their first product, named for the latitude of DeepOptics’ hometown of Tel Aviv, has tinted liquid-crystal lenses that realign into magnifying “readers” when the wearer swipes the temple with a finger. (A companion phone app allows users to set a specific reading magnification level.) A version with transparent lenses, switching between a distance Rx and close-up magnification, is planned. —Don Steinberg

Household**TELEMEDICINE FOR PETS***Dutch*

During the height of the pandemic, nearly 23 million Americans—1 in 5 households—got a cat or dog. Among them was new puppy parent Joe Spector, who immediately calculated the high cost of pet care and set about making it more accessible. The result is Dutch, a subscription-based telemedicine platform that connects pet owners to licensed veterinarians within an hour to treat nonemergency conditions like allergies, anxiety, and rashes. (If your pet requires blood work or lab tests, Dutch will triage with a local vet to schedule an in-person visit.) If you live in one of the 32 states that allow vets to prescribe virtually, Dutch will send medications and a treatment plan within 24 hours. —CAITLIN PETREYCIK

Outdoors**FULL-YARD BUG PROTECTION***Thermacell LIV Smart Mosquito Repellent System*

The great outdoors can easily be ruined by bug bites. From citronella candles to body sprays, many have promised respite, but Thermacell’s LIV is designed to de-mosquito an entire area—say, a backyard. Users install repellents with replaceable cartridges containing metofluthrin to form an outdoor coverage zone, and then operate it via a wall-mounted wi-fi-enabled hub. The app- or voice-controlled system allows schedules and timers, and alerts if repellent runs low. Demand for bug-free life is clear: the day it went on sale in March was the company’s biggest online-sales day ever. —SIMMONE SHAH

Trend**Travel upgrades**

Now that the world can travel again, new innovations are making it more convenient, comfortable, and—in an effort to reduce carbon emissions—sustainable.

For road trippers, the **F-150 Lightning** truck is an all-electric version of the best-selling vehicle in the U.S. And the **Sion**, a car with an entire outer shell of solar cells, aims to eliminate the need to plug in to charge.

For semi-mass transit, **Hyke’s Smart City Ferry** is an electric and solar-powered ferry, and **MagniX** plans to power aircraft with high-efficiency hydrogen fuel cells. **Sparky** the tugboat is the world’s first full-size fully electric tugboat, setting a new standard in shipping.

Then there’s travel gear. The **JordiLight** is a flexible flashlight that is brighter than a smartphone’s flash and comes equipped with a compass.

The **TernX Carry On** is a stroller that folds to the size of a carry-on suitcase, making airport travel with kids a whole lot easier. To keep your devices charged, the **Anker 757 PowerHouse** is a portable personal power station for when you’re camping or otherwise off the grid. (While you’re there, **Milo** is a communication device designed especially for outdoor sports, for use without wi-fi or cell signal.) Even in less remote situations, charging can be challenging, and the **Ossia Cota** power table charges devices on what is essentially a giant charging pad, eliminating competition for power outlets in airports and coffee shops.

—Jennifer Duggan

Social Good

FAR-REACHING DELIVERY

OX Delivers

In rural Rwanda, getting produce to market can be just as difficult as growing it. Even where paved roads reach, transportation can be unreliable and slow—farm products are often moved by bicycle. OX Delivers, a “clean-transport ecosystem” that allows farmers to book cargo space on trucks via cell phones, aims to make freight hauling more efficient. The company has rolled out a fleet of trucks in Rwanda that enables farmers to access distant markets at roughly the same price they would pay for bicycle cargo. Now the fleet, run by local OX Delivers drivers, is going electric, and the company has designed a truck for Rwanda’s rough roads. The first EV went into service this year, and more will roll out through 2024. —ARYN BAKER

Style

SUSTAINABLE FASHION

Spinnova Fiber

As awareness of fashion’s environmental impact grows, brands have begun using more sustainable materials, from recycled plastic fabrics to vegan leather made from mushrooms. This year, Adidas and H&M-owned Arket both released clothing in partnership with Spinnova, a Finnish company that developed a unique process for turning wood cellulose into textile fiber that can be woven into cotton-like fabric. Spinnova, which calls it “the most sustainable natural fiber in the world,” says that its production uses 99% less water than cotton production, and that it is made with renewable energy and without harmful chemicals. The company is to move out of its pilot-scale production space and into a full-size facility next year. —ELIZA BROOKE



Green Energy

A better lithium-ion battery

Sila Silicon Powder for Battery Anodes

For 30 years, graphite has played a key role in lithium-ion batteries, powering everything from small portable devices to electric vehicles. But now silicon is poised to take over, thanks to Sila Nanotechnologies’ innovative silicon powder. The California startup’s innovation took 10 years and 55,000 iterations, and has massive value for our battery-powered future: a silicon-based anode is about five times lighter and two times smaller than graphite-based anodes. That means smaller and more powerful batteries; Sila says its technology could increase a battery’s energy capacity by 20% to 40%. This year the company announced that it’s building a facility in Washington State to scale up production to support the auto industry. —Kalen Goodluck

Sustainability

RETAIL’S CARBON FOOTPRINT

Vaayu Carbon-Tracking Platform

Vaayu is a real-time carbon-emissions calculator and platform specifically made for retail companies. Built on life-cycle assessments and integrated with point-of-sale systems to gather up-to-date transaction data, Vaayu lets companies see carbon emissions from different supply-chain points and identify areas where they could reduce them. The startup currently has 60 retail partners. Vaayu even offers consumer-facing metrics, so shoppers can evaluate the footprint of products and delivery methods before they purchase. —JILLIAN MOCK

Transportation

DIGITAL SPEED LIMITS

Smart City Geofencing

The City of Gothenburg, Sweden, is developing a new frontier of safer streets: geofencing. It recently partnered with Volvo to create virtual perimeters that digitally control public buses. In zones around schools, the buses automatically slow down. And in emissions-free zones where air quality is tightly regulated, hybrid buses automatically switch to use electric power to reduce carbon emissions. The city hopes to make geofencing for public buses permanent. “In a truly sustainable city, people are not severely injured or killed in traffic,” says Suzanne Andersson of Gothenburg’s urban transport administration. —MATT ALDERTON

Automotive

ALWAYS-ON DASHCAM

Nextbase iQ

This next-gen 4K-resolution dashcam system delivers cutting-edge security features—and plenty more. Nextbase iQ offers Witness Mode, a voice-activated hands-free recording function that saves footage to the cloud and can notify an emergency contact of a stressful situation involving police or another driver. 4G LTE connectivity offers real-time global access via the iQ app, so you can check on your car while out of town. If there is a problem, you’ll be notified 24/7, because iQ is always on. In the event of a collision, the dashcam automatically moves into SOS Mode, alerting 911. The barrier of entry to new car innovation is high, says Nextbase’s Richard Browning, but his team is hopeful and expects a product launch in early 2023. —MARIAH ESPADA



Household**SEAMLESS
SMART HOMES***Thread*

As smart-home gadgets first proliferated, turning everything from light bulbs to thermostats high-tech, a problem emerged. Devices lacked a common language to connect to one another, resulting in frustrated homeowners and stifled innovation. So big tech companies got together to create a better standard: Thread, a wireless-mesh networking protocol that allows devices from different companies to communicate more reliably and using less power, saving battery life. Think of it as a connected home's backbone. In July, the nonprofit Thread Group consortium—members include Apple, Amazon, Siemens, and Google—announced the latest version. —KALEN GOODLUCK

Social Good**POWER FROM
SEAWATER***WaterLight*

Designed by Colombian renewable-energy startup E-Dina, WaterLight harnesses a chemical reaction between abundant resources salt water and magnesium to create an electrical current for generating light or charging mobile devices. Just a half-liter of salt water can provide light for up to 45 days. E-Dina recently launched a crowdfunding campaign with the goal of selling more than 100,000 units when it goes into production. WaterLight already has garnered thousands of preorders, along with three patents. "There are [millions of] human beings on the planet who do not have electricity," says E-Dina founding partner Nicolas Pinzón Córdoba. "We seek to be light where today there is only darkness." —MATT ALDERTON

Transportation**Minimalist's e-bike dream***Cowboy C4*

With its fourth-generation e-bike, which started shipping early this year, the Belgian-based startup Cowboy has created a minimalist's dream: the C4 is sleek and buttonless, with a matte frame and not one single visible cable. The C4's stripped-down aesthetic puts connectivity features front and center. A smartphone secures to the bike's stem-integrated "cockpit" for wireless charging and use of Cowboy's app—which provides directions, logs rides, details battery range, and allows users to connect with one another. That last feature has resulted in hundreds of Cowboy riders gathering for group rides in Paris. —Eliza Brooke

Beauty**A HEAT-FREE HAIR DRYER***Zuvi Halo*

Handheld hair dryers have barely changed in a century: they blast hair (and scalps) with very hot air. Zuvi Halo pivots to an infrared-light technology designed to mimic the way the sun evaporates rainwater. "With infrared light, we are only depositing the energy directly to the water, so we can keep the temperature lower," Zuvi chief scientist Xiaohu Zhang says. Cooler air means less heat damage, increased internal hair moisture, and longer color retention. Weighing just over a pound, it works as fast as a traditional dryer while using up to 60% less energy. With its low volume, ambient green glow, and gentle breeze, Zuvi Halo makes drying your hair a calming experience. —CAITLIN PETREYCIK

Trend

How to work hybrid

A bevy of new devices and apps are redefining what work can be in the hybrid world now evolving out of the COVID-19 pandemic. Organizations looking to make meetings with both on-site and remote employees feel frictionless can try **HP Presence**, a suite of cameras, microphones, and software. Tired of sharing screens and staring at faces during virtual meetings? **Switchboard's** interactive "rooms" allow real-time collaboration, while **Mesh for Microsoft Teams** lets participants appear as their metaverse avatars. Cloud-based human-resources platform **HiBob** is built for the tricky task of managing a distributed workforce.

Working from home can mean managing desktop device clutter—**Logitech's Logi Dock** aims to simplify by integrating mics, speakers, and peripheral plugs galore. Digital nomads in need of a highly portable second display can try the **Duex Max** laptop monitor, while the **Audeze FILTER** conference speakerphone eliminates annoying background noise, whether at home or in a coffee shop. And the **Linklet** neck-worn wide-angle camera is ready for hands-on demonstrations during videoconferences.

Meanwhile, tech is reaching all sorts of places. **Phantom Auto's** remote-operation platform for logistics allows forklift operators to work from home rather than in warehouses. Stressful day at work? **Sensate 2**, a wearable device that stimulates the vagus nerve, aims to calm anxious minds. —Jeremy Gantz

Entertainment & Gaming

PRECISION AUDIO

Holoplot X1 Matrix Array

Holoplot's speaker system—with 96 drivers controlled by software that can project sound to precise locations—aims to create entirely new sonic experiences. Atlanta's Illuminarium uses Holoplot's X1 for its immersive audiovisual experiences, and the MGM Sphere—a \$1.8 billion structure opening in Las Vegas in 2023 with the world's largest sound system—will use an X1 array with 157,000 audio channels. Designed for public spaces at upwards of \$100,000 per installation, it is also aimed at train stations and conference venues. "You could have one side of the room hearing in French, the other side in English," says Holoplot's Thomas Barker-Harrold. —DON STEINBERG

Wellness

SOUND ASLEEP

Kokoon NightBuds

Struggling to sleep? Tim Antos did too. After he learned how different sounds can facilitate sleep, his company, Kokoon, developed NightBuds. As a user listens to music, a podcast, or Kokoon's library of sounds, NightBuds' biometric earbuds—just 5.4 mm thick—sense the wearer falling asleep and then fade to gentle white noise. Loud traffic disturbance at 2 a.m.? NightBuds' dynamic noise masking dials up the white noise. The MyKokoon companion app provides long-term insights to improve sleep quality. "We all sleep, and we can all do it better," Antos says. One company study found that 2,000 users spent 15% more time in deep sleep (on average) after using NightBuds for one month. —NOVID PARSI

Transportation

HOME DELIVERY BY DRONE

Zipline Logistics and Delivery System

Zipline revolutionized health care across parts of Africa by delivering vital medical supplies via drone in areas unreachable by road. Now it is bringing its expertise to the U.S. In November 2021, Zipline announced a partnership with Walmart to deliver small packages straight to customers' front doors within 50 miles of its drone distribution center in Pea Ridge, Ark. Zipline's drones don't land; they airdrop parachute-protected packages within 15 minutes of ordering. Through another partnership with a health care organization in the Salt Lake City area, Zipline is delivering prescriptions, harking back to the company's roots. —ARYN BAKER

Apps & Software

REVEALING DEEPPAKES

Truepic Lens

In seconds, AI can generate an image of a jeep in a car crash that could be used for insurance fraud.

Truepic Lens, which securely documents the provenance and alteration history of photos and videos, makes deepfakes like this harder to pull off. The software tool authenticates the original media-capture device and associated metadata, then renders that information tamper-proof. Truepic Lens can be integrated into marketplaces like Airbnb and applications like Photoshop. It's all about carrying origin data from "glass to glass," says Truepic's Nick Brown. "The whole point is to restore trust." Truepic clients include Equifax, the Antiquities Coalition, and citizen journalists. —ALI WITHERS



BEST
Inventions
2022Style**ANTIDOTE TO FAST FASHION***ThredUP Thrift the Look*

Anyone who loves thrift shopping will tell you this: it's all about the thrill of the hunt. But sniffing out that one perfect piece requires lots of time and effort. To make secondhand shopping more accessible—and enable consumers to make more sustainable purchases—clothing-resale site ThredUP created an AI-powered search tool called Thrift the Look. It features a curated selection of street-style photos and stylist-created outfits; users can click on individual items in those photos, surfacing a list of close matches from ThredUP's inventory. Celebrity stylist Karla Welch and *Stranger Things* actor Priah Ferguson have each devised a number of shoppable looks for the tool.

—ELIZA BROOKE

Food & Drink**Mushroom magic***Meati Crispy Cutlet/
Chicken Cutlet*

Fungi-based meat alternatives have been gaining popularity—and a lot of venture capital. Meati's crispy cutlet and chicken cutlet, which debuted in March, are 95% mycelium (mushroom root). Both cutlets, one breaded and one not, look and taste remarkably like actual chicken because they're whole cuts of the naturally fibrous root, which Meati gently texturizes. "We want to maintain the nutritional integrity of the mushroom root in the final product," says co-founder and CEO Tyler Huggins, who studied fungi as a field biologist with the U.S. Forest Service. —Jeremy Gantz

Accessibility**FIT HEARING AIDS***Phonak Audéo Fit*

Hearing aids are often stigmatized as a device for the old or infirm. But the latest hearing aids are anything but old-fashioned: they're teched out with AI, fitness trackers, streaming capability, and more. Now Phonak is out with the first commercially available hearing aid with a heart-rate sensor. Audéo Fit's receiver-in-canal device tracks fitness data, such as steps, activity level, and distance walked, while also monitoring the wearer's heart rate when paired with the MyPhonak app. Currently available through licensed hearing-care providers, Audéo Fit pairs with up to eight Bluetooth devices, including smartphones and TVs.

—LESLIE DICKSTEIN

Wellness**CHILL OUT***Sleepme Dock Pro Sleep System*

Sleepme's founders have bed tech in their heritage; president Todd Youngblood's uncle invented the waterbed. The company's app-controlled Dock Pro system also uses water, but in a very different way: continuously circulating water in a mattress pad to keep your bed at precise desired temperatures, triggering sleep and wake cues. "In an ideal world, you want to drop 2° in core body temperature to facilitate good sleep," CEO Tara Youngblood says. A peer-reviewed study published this year also showed the tech effective at reducing menopausal hot flashes. The pad is available for one or two sleepers (the latter has two separate climates). —DON STEINBERG

Trend**Reducing corporate emissions**

As tackling climate change becomes more urgent, companies are under pressure from customers, shareholders, and employees to become more sustainable.

Data is vital: without measuring emissions, it is difficult to reduce them. **Watershed** is a platform that tracks companies' carbon emissions across entire operations and stores the data in one easily accessible place. The **Actual ESG Transformation Platform** uses modeling software and ESG approach to help companies design and implement sustainability strategies.

nZero works with governments and NGOs to give accurate energy usage reports. Utility companies can also use the **AI Fluence IQ** bidding application to forecast the best renewable-energy prices. Photovoltaic panels are less effective if they get dirty, and the fully autonomous **SolarCleano F1A** robot cleans panels safely.

For local governments, **Aclima** tracks pollution, emissions, and air quality on a block-by-block basis. The **2030 Calculator** by Doconomy gives buyers the power of knowledge by measuring the carbon footprint of individual products. And **Sourcemap** lets companies track waste, fraud, or abuse in their entire supply chains.

Companies can also switch to more sustainable materials, such as **NuCycl's** new engineered fiber made from discarded clothing, or partner with **Twelve: CO2**, a company that turns carbon in the air into product components that are normally made using fossil fuels.

—Jennifer Duggan



Productivity

Creating digital twins

Leica Geosystems BLK2FLY

This autonomous flying laser scanner can capture detailed dimensions of structures, buildings, and other hard-to-reach (or dangerous) areas. It's not a drone, because you don't have to pilot it. Instead, the device uses radar sensors, cameras, and GPS—all packed into a compact carbon and glass fiber frame—to create what Leica Geosystems calls "3D digital twins," while navigating around any obstacles such as trees and wires. "It takes less than 10 minutes to create a model of a New York City high-rise," says Burkhard Boeckem, chief technology officer of Hexagon, which owns Leica Geosystems. But it's for more than just the world of architecture, engineering, and construction: BLK2FLY, which went on sale in April, has been used to monitor structural safety across 160 acres of Italy's Archaeological Park of Pompeii. —Ashley Mateo

Sustainability

ENDING FOREVER CHEMICALS

Zume and Solenis PFAS-Free Packaging

It's bad enough that an estimated 300 million tons of plastic waste are produced globally each year, and little of it is recycled. Worse, much of that rubbish contains per- and polyfluoroalkyl substances (PFAS), which are linked to a range of harmful health effects and informally known as "forever chemicals" because that's pretty much how long they stick around. Zume, a manufacturer of food containers and other products, and Solenis, an industrial chemicals producer, partnered to do something. In April they launched a biodegradable PFAS-free packaging line—that includes cups, bowls, and egg cartons—made principally from plant fibers that would ordinarily be discarded as agricultural waste. —JEFFREY KLUGER



LEICA, ZUME: SERGIY BARCHUK FOR TIME

Toys & Play

A REAL INSPIRATION

Mattel Dr. Jane Goodall Barbie

Pioneering primatologist Jane Goodall is the latest subject of the Barbie Inspiring Women Series, which celebrates "courageous women who took risks." The doll representing the renowned chimpanzee expert is made from a minimum of 75% recycled plastic. Launched in July, the carbon-neutral doll can be purchased with a figure of David Greybeard, the first chimpanzee Goodall worked with at Gombe National Park in Tanzania in 1960. "My entire career, I've wanted to help inspire kids to be curious and explore the world around them," Goodall said upon the doll's launch. Others in the series include Rosa Parks, Eleanor Roosevelt, Maya Angelou, and Florence Nightingale; Goodall is the first to be made with recycled materials. —J.D.

Wellness

HOME CHECKUP

Withings Body Scan

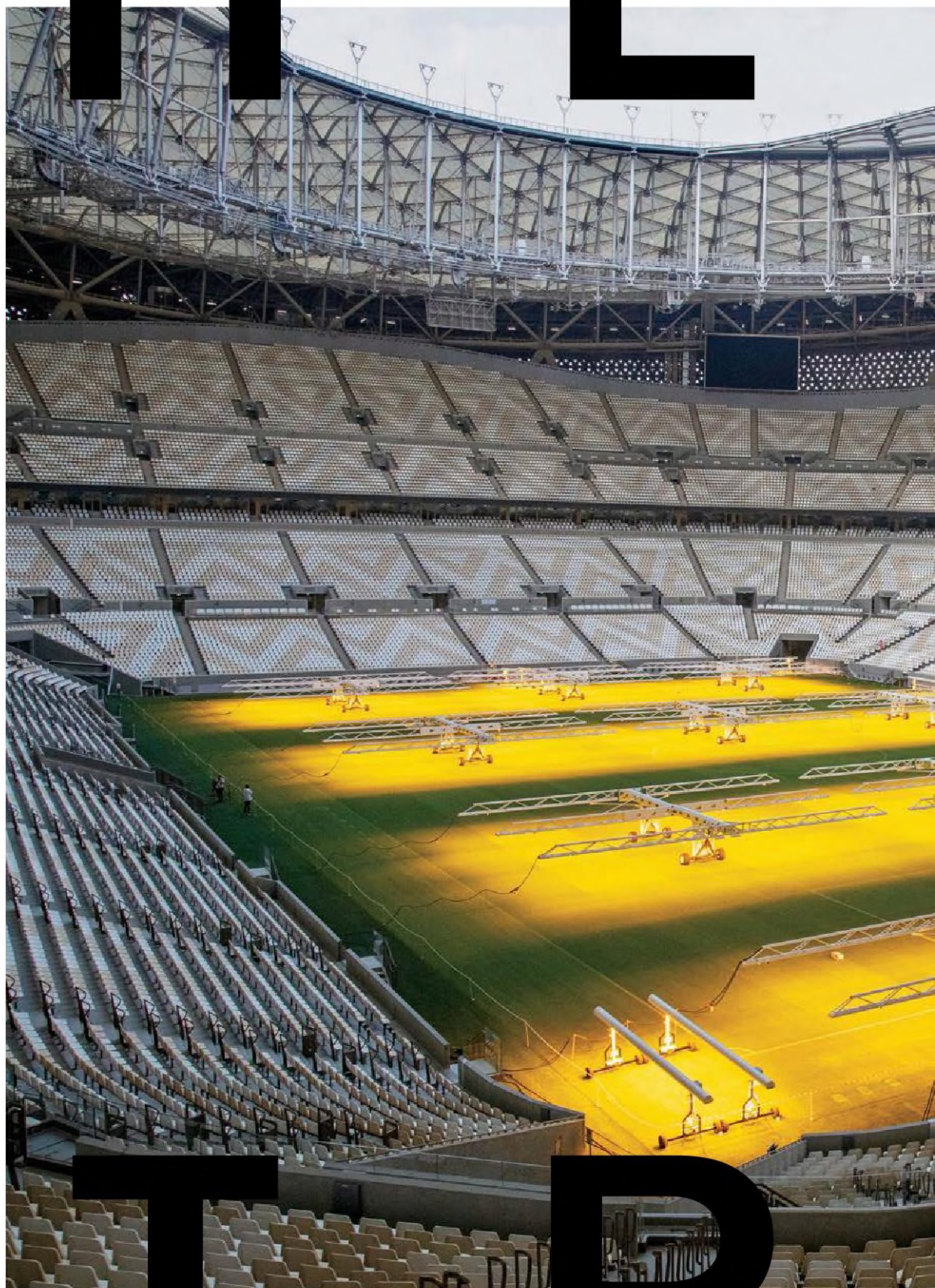
It may look like a scale, but the Withings Body Scan goes way beyond weight, measuring body composition, heart rate, vascular health, and more. But unlike other smart scales that calculate muscle, fat, and water mass based only on readings from your feet, its retractable handle with electrode sensors allows measurements specific to the legs, arms, and torso. By tracking sweat-gland activity, for example, it can assess nerve activity associated with illnesses like diabetes. And by monitoring vascular age and heart rhythm, it can help improve cardiovascular health (an app offers personalized health plans). "We will turn the morning weigh-in into a sophisticated home health check," Withings CEO Mathieu Letombe says. It is slated for a 2023 launch following FDA approval.

—MATT ALDERTON

WORLD

**THE WORLD CUP HAS
BROUGHT GLOBAL
ATTENTION TO THE
DEADLY PERILS OF
WORKING IN EXTREME
TEMPERATURES—AND
A NEW MODEL FOR
DOING SO SAFELY**

**BY ARYN BAKER/DOHA
AND KATHMANDU**





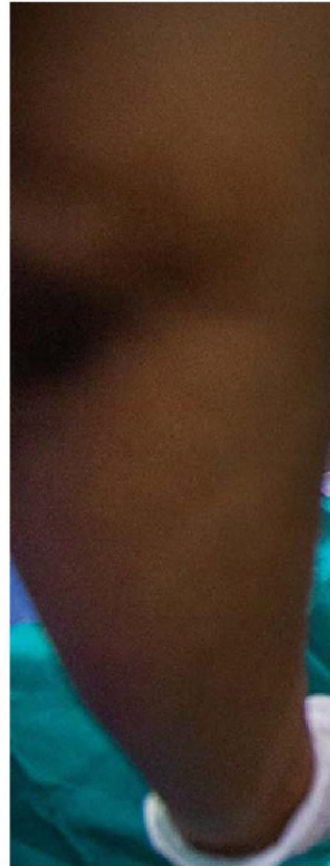
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◀
GROW LIGHTS SPEED
GRASS GROWTH AT LUSAIL
STADIUM, HOST OF THE
2022 WORLD CUP FINALS

PHOTOGRAPHS BY
ED KASHI—VII FOR TIME

WORLD

Not long after the Gulf nation of Qatar was awarded the rights to host the 2022 World Cup soccer championships, Surendra Tamang hatched a plan to go.



He had heard that Qatar was recruiting many other Nepali laborers to work in Doha building the stadiums and related infrastructure projects. So in 2015 he took out a loan to cover the recruitment agency's fees and applied for a construction job. He figured he would work up until the World Cup, sending his earnings back home while putting enough aside to buy a ticket to the final match. Only then would he go back to Nepal, triumphant, rich (or at least richer than his neighbors), and with a World Cup T-shirt featuring Argentina's Lionel Messi, his favorite player.

Instead, in October 2021, he was sent home with a mysterious, crippling ailment that his employers dismissed as gastritis—chronic indigestion—and claimed had nothing to do with the arduous conditions at his work site. By the time he arrived at a Kathmandu hospital in debilitating pain, both his kidneys had given out, wrecked by working long hours of hard labor in punishing heat, according to his doctor. “I used to have dreams,” Tamang says from his hospital bed at the dialysis clinic of Nepal's National Kidney Center. Now 31 and with no potential kidney donors on the horizon, he will likely be on dialysis for the rest of his life, forced to watch the World Cup on his phone.

Every four years, for four weeks, World Cup host countries open their doors to millions of fans, investing national pride in ever more fantastic stadiums purpose-built for the world's most popular sport. Qatar has spent more than \$200 billion on construction that offers a preview of future technologies, from outdoor air-conditioning to retractable roofs. But these games also offer a sobering preview of another future, one in which the kinds of record-breaking heat waves that roasted Asia, Europe, and North America

this summer are no longer extreme events but seasonal norms brought about by a changing climate. Those rising temperatures will change the future of work, making outdoor labor increasingly dangerous to human health in the hottest parts of the year, across most of the globe.

This year, the World Cup will start on Nov. 20, five months later than usual, to spare players and fans the worst of the region's blisteringly hot summer. But preparations for the tournament—a building boom in one of the hottest places on the planet—took more than a decade. To make it happen, Qatar relied on a global supply chain of laborers willing to work in any conditions—a desperation fueled in part by the impacts of climate change. Qatar's 2 million-strong foreign workforce, which makes up more than two-thirds of the population, is largely recruited from Nepal, India, and Bangladesh. Thousands of those workers have died over the past decade, many because of poor working conditions made more perilous by excessive heat. Indeed, human-rights organizations like Amnesty International say migrant workers, especially from Southeast Asia, have been at risk for exploitation and abuse in Qatar for years, as the country has risen to become one of the wealthiest in the world—first through its fossil-fuel reserves and, more recently, thanks to its fast-growing tourism industry.

Doha's daily high temperatures are now 1.4°F warmer in summer, on average, than when the World Cup was announced 12 years ago. The Middle East is one of the fastest-warming places on the planet, but the rest of the world is not far behind. By 2100, temperatures could rise to the point that just going outside for a few hours in some parts of the Middle East, Africa, and Asia will exceed the “upper limit for survivability,



▲ SURENDRA TAMANG GETTING DIALYSIS TREATMENT IN KATHMANDU ON JUNE 28

even with idealized conditions of perfect health, total inactivity, full shade, absence of clothing, and unlimited drinking water,” according to a 2020 study in *Science Advances*. Construction work under those conditions will be impossible.

In contemporary Qatar, however, workers can still be protected from the effects of excessive heat. That so many were not over the past decade is a stain on the country’s legacy. But it is also a learning opportunity. The World Cup spotlight forced drastic changes in labor regulations that, since their implementation last year, have made Qatar a world leader in heat protection and a useful laboratory for a better understanding of what works—and does not work—in an era of climate change. Already the U.N.’s International Labor Organization (ILO) calculates that the increase in heat stress will lead to global productivity losses equivalent to 80 million full-time jobs by 2030. Meanwhile, recent heat waves have catalyzed international campaigns to get heat recognized as an occupational hazard, and labor activists as well as government entities are pushing for stronger regulations and laws to protect outdoor workers, whether they’re building stadiums, harvesting crops, or sweeping streets. Qatar could end up providing the template.

SURENDRA TAMANG ARRIVED in Qatar in the late spring of 2015. Despite the vivid descriptions by friends recently returned from the Gulf, he was unprepared for Doha’s furnace-like heat. One of his first tasks at the Doha Oasis construction site, the luxury residential and entertainment complex in downtown Doha that was his place of employment for six years, was in scaffolding—an assignment that required a heavy harness and a hard hat, which sent rivulets of sweat

cascading down his body within minutes of going outside. When the summer reached its zenith and temperatures approached 112°F (44.4°C), he and his fellow laborers worked on, taking a break only for a few hours at lunch to avoid the hottest part of the day. As the years passed, he grew accustomed to the bloody noses, headaches, muscle cramps, and vomiting that accompanied work in Qatar’s May-through-September summer season. He regularly fought off dizziness and witnessed several colleagues collapse from heat exhaustion. He did too, a few times. *TIME* reached out to Tamang’s employer, Redco Construction Al Mana, as well as the Doha Oasis, but received no response.

Summers in Qatar are not just hot, they are also humid, a dangerous combination. The only way the human body can cope with heat is by producing sweat that cools as it evaporates. The higher the humidity, the less evaporation, leading to a rise in core temperature, and eventually organ failure. Scientists use an index called the wet-bulb globe temperature, or WBGT, to assess the impact of heat and humidity. Developed by the U.S. Marines in the 1950s, it combines temperature,

humidity, and solar-radiation measurements into a single number expressed as a temperature. A WBGT above 95°F (35°C) is considered to be the “threshold of survivability.” A reading of 90.5°F (32.5°C) is considered the redline for heat injury for any kind of activity. That’s the equivalent of 93°F at 50% humidity—a typical late summer afternoon in Qatar.

In 2007, Qatar banned outdoor work between 11:30 a.m. and 3 p.m. during the summer; as a result, construction companies divided the work into early-morning and late-afternoon shifts. Tamang got the morning shift, starting his day at 4 a.m. so he could eat breakfast and prepare his lunch at the company-run worker colony—where up to 70,000 workers employed by various contractors eat, sleep, and spend their time off—before taking a shuttle bus to the work site an hour and a half away. Still, the early start gave him no relief—the temperature was slightly lower, but the humidity surpassed 70% in the morning hours, driving the WBGT even higher.

At Tamang’s construction site, workers were doing heavy physical labor in heat conditions that even the Marines would consider dangerous. Like most of his co-workers, Tamang pushed through the headaches and dizzy spells, worried that if he took too many breaks, his employer would dock his pay or send him back to Nepal. He knew he needed to stay hydrated, but the bottles of cold water sold nearby cost the same as a Coca-Cola, so he opted for soda. When he was working on high scaffolding, he tried not to drink anything

WORLD

▼ A WORKER ON A
CONSTRUCTION SITE
IN LUSAIL CITY TRIES
TO STAY HYDRATED



at all, so he wouldn't have to climb down to use the toilets.

Over time, Tamang's increasingly frequent dizzy spells, bouts of nausea, muscle weakness, and fatigue got to the point where work became impossible. He went to the construction company's doctor, who gave him medicine for gastritis and told him to avoid spicy foods. Still, his symptoms persisted, and the company eventually moved him to desk work in an air-conditioned office, but by then it was too late. At follow-up appointments, company doctors warned him about his blood pressure, but he says no one ever tested for kidney disease. His employer ordered him back to his dormitory for two weeks without pay, to regain his strength. When he didn't recover, the construction company terminated his contract and sent him back to Nepal.

Tamang had been sending the bulk of his \$400-a-month salary home to his family, part of a \$10 billion river of remittances that flows into Nepal every year from Nepali migrant workers employed abroad; it accounts for nearly a third of the nation's GDP. For farming communities like Tamang's, the transfers have become an essential buffer against the floods and drought caused by climate change that are making agriculture increasingly unreliable.

In June 2022, Indrajit Mandal, a 22-year-old rice farmer in the southern Nepali village of Nagarain, paid a recruiter the equivalent of \$1,200 to secure a job in Qatar. (Nepal outlaws recruitment fees for foreign labor contracts; the recruiter says he took only a "small commission.") "People are coming back from Qatar with kidney disease and heart attacks," says Indrajit. "But I am ignoring this because we have no choice." His uncle Kripal Mandal, who had been working construction in Qatar for 12 years, died this year of a heart attack at age 40, and Indrajit suspects it was caused by chronic exposure to extreme heat. Death certificates for deceased

migrant workers in Qatar frequently cite "cardiac arrest" as the cause, suggesting their deaths were not work-related. But the reality is that most of these people are young and healthy; indeed, all workers must pass a basic "fit for work" health screening before obtaining a Qatari work visa. And so the high rate of cardiovascular disease listed as the cause of death among migrant workers in the country points to some other cause of the problem.

According to co-authors of a 2019 study in *Cardiology* that analyzed more than 1,300 Nepali migrant-worker deaths in Qatar from 2009 to 2017, nearly half were attributed on death certificates to cardiovascular disease, a rate that far exceeds the 15% global norm for men in a similar age bracket. When the figures were broken down by season, death rates due to

heart attack went down to 22% in the winter and leaped to 58% in the summer. Many of the deaths occurred during periods when the WBGT exceeded 87°F (31°C), leading the authors to conclude that at least 200 men likely died from heat injuries sustained by working, even though the cause was listed as cardiac arrest. Qatar's labor law requires employers to pay compensation only if a death is work related, which is usually, narrowly interpreted as taking

place at the work site. A heart attack that occurs in worker accommodations at the end of a strenuous day, as happened with Indrajit's uncle, doesn't qualify. But even relatively lower levels of heat stress can cause severe problems over time, especially if accompanied by chronic dehydration.

When nephrologist Dr. Rishi Kumar Kafle launched Kathmandu's National Kidney Center 25 years ago, he expected to serve older patients suffering from the kind of kidney problems that accompany age and chronic diseases such as diabetes and hypertension. But over the years, his patient numbers increased, and their average age went down. Most

**'They are healthy.
Then suddenly they
develop kidney failure.'**

—DR. RISHI KUMAR KAFLE, FOUNDER
OF NEPAL'S NATIONAL KIDNEY CENTER

▼ CONSTRUCTION
ABOUNDS IN DOWNTOWN
DOHA AS QATAR PREPS
FOR THE WORLD CUP



▼ WORKERS IN LUSAIL
CITY SWITCH TO COOL
INDOOR WORK WHEN THE
TEMPERATURE RISES



of his younger patients had one thing in common: recent employment abroad. Today, he estimates that returnees from the Gulf countries make up 10% of his caseload. “These young men coming back from the Gulf don’t have diabetes; they are not hypertensive. They are healthy. Then suddenly they develop kidney failure. It means that there is something in the Gulf which makes certain young people sick.” A number of factors are at play, he says: continuous dehydration, bad diet, stress, and excessive use of painkillers to dull the aches and pains of hard labor. But the main underlying issue is heat.

The solutions are fairly simple: hydration, rest breaks, and respite from the sun. Trials with sugarcane workers in Nicaragua have shown that when laborers are allowed to take frequent water breaks in the shade, incidents of kidney damage go down dramatically and productivity goes up, according to a 2020 study published in the journal *Occupational and Environmental Medicine*. “Water. Rest. Shade. It’s not rocket science. It’s not expensive. And it saves lives,” says Jason Glaser, a lead author of the study and the director of La Isla Network, the nonprofit occupational-health organization that pioneered the worker-safety plan.

THREE YEARS AFTER QATAR started construction on the World Cup stadiums in 2011, the International Trade Union Confederation published an exposé warning that some 4,000 migrant workers would likely die before the opening match as a result of the country’s exploitative labor practices. The projections were based on a tally of migrant worker deaths in 2012 and 2013 released by the Indian and Nepali embassies, and was supported by similar reports from Amnesty International and Human Rights Watch, which described squalid dormitories, grueling work hours, unpaid wages, and dangerous health-and-safety practices in the country. A February 2021 investigation by the *Guardian* tallied more than 6,500 worker deaths in Qatar since the awarding of the World Cup, firmly laying the responsibility at the feet of FIFA, the international soccer federation that governs the event.

But Qatar’s building boom goes far beyond the World Cup. More than 3,750 construction projects were completed in 2020, and thousands more are ongoing. Nearly every block beyond central Doha features a newborn edifice swaddled in scaffolding; construction cranes compete with skyscrapers as the dominant feature of the city skyline. While the frenetic pace of development may have been galvanized by the awarding of the World Cup, not all of it is directed toward hosting games or catering to fans. Ever since the launch, in 2008, of the Qatar National Vision 2030, the government has worked to transform the gas-rich nation into a business and transportation hub for the region, diversifying the economy away from fossil fuels and building the city-state into a modern metropolis with the addition of hundreds of office towers, hotels, residential blocks, entertainment centers, and the necessary infrastructure to keep the city thriving.

The irony is that for all the focus on World Cup stadiums, the most egregious abuses happen at private construction projects like Tamang’s that have little to do with soccer. Qatar’s Supreme Committee for Delivery & Legacy, in charge of World Cup preparations, employed only 35,000 workers at its peak, accounting for less than 2% of the country’s migrant labor force over the past decade. Some of those non-World Cup-related work sites are well regulated, but others are not. TIME was granted permission to visit one privately run work site, a luxury residential complex that won’t be completed until long after the World Cup is over, accompanied by officials from the Ministry of Labor. The workers, interviewed in the presence of their supervisors, appeared content with the regulations governing heat protections. They complained of the heat—112°F (44°C) at 9 a.m. on the day we visited—but said that they were allowed to take breaks in cooled rest areas when it got too hot; that their supervisors frequently passed out water and reminded them to hydrate; and that if the WBGT index went past a certain point, outside work would stop entirely. Laborers from other sites that TIME was not allowed to visit described the one we did as

WORLD

An unexplained death in Qatar

an exception, not the rule. One Nepali health-and-safety supervisor, who has been employed on Qatari construction sites since 2002, and who asked not to be named for fear of losing his job, says conditions “are improving, but still not fast enough to save lives.”

In May, several labor and human-rights organizations demanded that FIFA set aside \$440 million—the same amount it hands out in World Cup prize money—for the welfare of workers who suffered human-rights abuses in Qatar during preparations for the 2022 World Cup. The campaign has received global support, and FIFA told Amnesty it was “considering” the proposal. But even if FIFA agrees to some sort of compensation scheme, differentiating between World Cup workers and those laboring on construction sites that may or may not have been spurred on by the World Cup announcement will be difficult.

According to an assessment released by Building and Wood Worker’s International, a labor union based in Geneva, construction sites run by the Supreme Committee “ensured a higher than industry level of protection ... including new methods for monitoring and mitigating the effects of heat stress.” Mahmoud Qutub, the Supreme Committee’s executive director for workers’ welfare and labor rights, says every World Cup work site offered cooled rest areas and mandatory hydration breaks. They also closed during the hottest part of the day in summer, and laborers were given specially designed cooling suits. They were also allowed to take breaks whenever they felt the need. These health-and-safety protocols, Qutub says, reduced “workplace-related” fatalities among the overall World Cup construction effort to only three across 10 years, none due to heat. While those numbers are backed by the U.N., they reflect an overly strict definition of work-related. The Supreme Committee’s own annual reports cite 36 non-work-related deaths caused by “respiratory failure,” “heart attack,” “natural causes,” a shuttle-bus accident on the way to a work site, and one case of suicide. That said, even if those deaths are included, World Cup construction-site fatality rates are far lower than Qatar’s work-site fatality rate as a whole, demonstrating that workers can be protected when it is made a priority.

In 2019, the government made it a priority. Hounded by condemnations from the press, international labor unions, and human-rights groups, Qatar brought in representatives from the ILO and other experts to undertake a comprehensive study of the country’s labor conditions, with the goal of

SEAL OF QATAR’S HEALTH AGENCY

The Qatari authorities have not released comprehensive health data for their migrant workforce. Without a better understanding of what is killing young, otherwise healthy workers, there can’t be a solution.

PERSONAL DETAILS

Saphi left Nepal in July 2019 for a job on a Qatari construction site. He took out a \$1,800 loan to pay for the recruitment fees, and was paid approximately \$330 a month.

AGE

Most migrants are in their 20s or 30s. They are required to pass a “fit-for-work” medical exam in Nepal and are generally healthy before they go.



DATE OF DEATH

The day before Saphi’s death, on June 20, temperatures spiked to 113°F. Without more details, we cannot know for certain what caused his heart failure, but heat and exertion could have contributed.

NEPALESE NOTARY STAMP

A notarized death certificate is required to apply for compensation from a Nepali government-funded insurance scheme for overseas workers. The payout is approximately \$5,300 to the family. Saphi’s family is still waiting to receive theirs.

CAUSE OF DEATH

Rarely are contributing factors like heat cited as the cause of death. Most often it is simply listed as “acute heart failure,” “respiratory failure,” “heart attack,” or “natural causes.” These are not considered to be work-related, and thus the families of the victims are not compensated.

‘Water. Rest. Shade.
It’s not rocket science.’

—JASON GLASER,
DIRECTOR OF LA ISLA NETWORK

implementing reforms. They spent several summer weeks on Qatari work sites monitoring labor conditions. Some workers agreed to ingest electronic devices that could record body temperatures and dehydration levels, to help researchers understand the impacts of high heat and humidity, and tested mitigation efforts like cooling suits, hydration solutions, work-rest ratios, and air-conditioned break rooms.

At the end, the researchers suggested Qatar’s Ministry of Labor add an extra hour and a half to the daily midday outdoor work ban in summer while expanding the “summer” schedule an additional four weeks—representing a reduction of 586 work hours a year. They advised companies to establish cooled rest areas and implement hydration protocols, and recommended setting a maximum WBGT threshold of 89.7°F (32.1°C), at which point all outdoor work would cease, no matter the time of day or year.

That’s still too high, according to some heat researchers, but it’s a workable compromise, according to Andreas Flouris, the founder of the University of Thessaly’s FAME laboratory, which Qatar brought in to the country to assess its work environment. “32.1°C keeps workers safe,” says Flouris. “At the same time, it keeps the economy humming, because being unemployed also hurts worker health.” His team also recommended that all outdoor workers undergo annual health screenings so that those with hypertension, diabetes, or other chronic conditions could be identified,

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MANJU DEVI
MANDAL HOLDS A
PORTRAIT OF HER
HUSBAND KRIPAL,
WHO DIED WHILE
WORKING IN QATAR

diagnosed, and moved to less strenuous positions. Further reforms, suggested by Building and Wood Worker's International and the ILO, ended the *kafala* sponsorship system that tied workers to their employers and did not allow them to change jobs or leave the country without permission. Qatar turned those recommendations into law in May 2021. Almost overnight, a country synonymous with worker oppression adopted the world's most progressive heat-protection strategy. Anecdotal, Qatar's new policy has been transformative. According to the ILO's annual report on Qatar, hospital admissions to health clinics for heat-related disorders dropped from 1,520 in the summer of 2020 to 351 in the same season of 2022.

But government data on worker deaths and injuries, both before and after the implementation of the new law, are nonexistent, unavailable to researchers, or so vague as to be useless. Qatar is sitting on a gold mine of data that could be used to establish and refine heat-protection policies for workforces around the world, says Flouris, but so far it is not willing to share it. Doing so would expose past mistakes, to be sure, but it could prevent future deaths. "Qatar has the most amazing natural laboratory you can think of. If you can protect workers there, you can protect them anywhere," says La Isla Network's Glaser. "You look like a hero when you own it. Qatar could say, 'We screwed up. Nobody has been doing this right. We're gonna take the lead to make sure that what happened here never happens anywhere else.'"

Qatar's Ministry of Labor shut down more than 450 work sites for violations of its new heat-protection policy this summer. It's a sign of effective monitoring, but the ministry has no enforcement capacity, so violators are often back in

operation within days. Nor does the government have the capacity to inspect every work site on a frequent enough basis to ensure worker safety, says Ambet E. Yuson, the general secretary of Building and Wood Worker's International.

The most effective way to enforce the new policy would be to empower workers to stand up for the rights it now guarantees. So far, it's not looking good. Fifty-six migrant laborers were arrested or deported for protesting unpaid wages in August, says Yuson. "If workers that haven't been paid a salary for seven months are deported for complaining, what does that say about workers being willing to stand up for the proper implementation of heat protections on their work sites?"

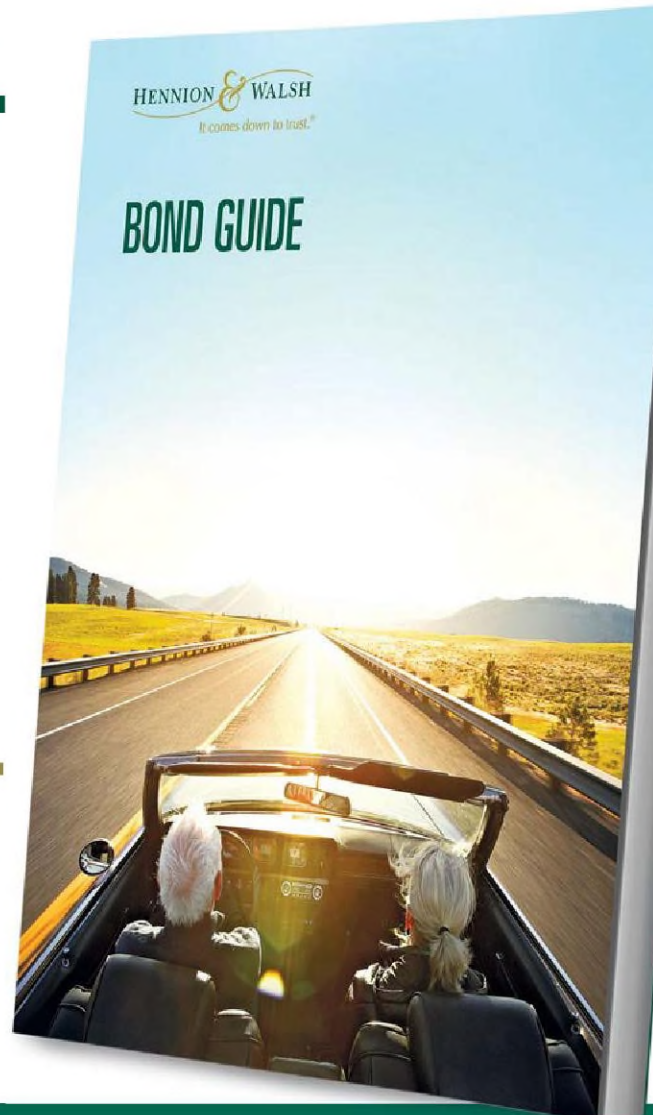
Tamang now believes that if he had worked on a World Cup stadium project, instead of a luxury hotel, he probably would have made it to the final. The better health outcomes at sites that adhered to strict heat-protection protocols prove that productivity and protection can go hand in hand, says the Supreme Committee's Qutub. The question now is whether worker health will continue to be prioritized when the last World Cup fan goes home and the spotlight turns away from Qatar's migrant labor force.

Tamang is skeptical. Back in his bed at Nepal's National Kidney Center, he listens to messages from friends who stayed behind in Qatar to work on other construction projects, as he waits for his dialysis appointment to end. "It's disastrous here," says a former roommate, complaining of unpaid wages, terrible work conditions, and abusive behavior. "I'm not surprised," says Tamang. "I was expecting that kind of message." —*With reporting by RAMU SARKOTA/JANAKPUR; SWETA KOIRALA/KATHMANDU; and EMILY BARONE, LESLIE DICKSTEIN, ANISHA KOHLI, and SIMMONE SHAH/NEW YORK* □

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CHINA WATCH

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Summit of achievement

Fanjing Mountain attracts visitors with its stunning scenery

BY XU LIN
and YANG JUN

With troops of naughty monkeys, imposing bears, coiled snakes, precious flora and fauna, and vertiginously placed ancient architecture... the amazing beauty of Fanjing Mountain in Tongren city, Guizhou province, which resembles a wonderland, is an internet sensation.

The area's fame reached its peak, literally, in 2018, when Fanjing Mountain was added to the UNESCO's World Natural Heritage List due to its range of biodiversity with more than 7,100 species of wild animals and plants.

"It's important to cultivate a region's unique value from a global perspective to apply for the list, and Fanjing Mountain meets that standard," says Rong Li, a professor at Guizhou Normal University, one of the experts who participated in the site's application.

In 1978, Fanjingshan National Nature Reserve was established to protect the area's precious wild animals and plant species, along with the virgin forest ecosystem.

Balancing environmental protection and tourism development is an issue for such a nature reserve. It cannot be achieved without input from the locals, the authorities and experts.

"The successful entry into the list brought a record number of 1.45 million tourists to the mountain in 2019," says Tao Huayuan, head of Wuling Scenic Area Management Co. Ltd., which is in charge of Fanjing Mountain scenic area.

Tao says the development of the mountain's tourism is based on strict protection of the ecosystem. He is looking forward to the establishment of Fanjing Mountain National Park, which was approved by the authorities in May.

To meet the diverse demands of visitors, the plan is to make creative cultural products and develop tourism products for healthcare. An exhibition hall on local wildlife will also be built.

The locals have moved out of the



Fanjing Mountain, one of UNESCO's World Heritage Sites, in Tongren city, Guizhou province. PHOTOS PROVIDED TO CHINA DAILY

“
IT'S IMPORTANT TO CULTIVATE A REGION'S UNIQUE VALUE FROM A GLOBAL PERSPECTIVE TO APPLY FOR THE LIST, AND FANJING MOUNTAIN MEETS THAT STANDARD.”

RONG LI,
A PROFESSOR AT GUIZHOU
NORMAL UNIVERSITY

core area of the nature reserve and settled down in homes built by the government.

To develop communities, the scenic area gives priority to locals in job opportunities, so they do not have to go to work in big cities.

They can also stay in their hometown to do tourism-related businesses, such as opening a homestay.

Among them is Yang Yuanju, 50, from Zhaisha Dong village at the foot of the mountain. In 2011, she opened a homestay via an interest-free loan from the local government and paid back the debt within two years.

Booming tourism brings flows of visitors, who stay in the village's traditional stilted buildings and experience the exotic ethnic group culture. Yang says she enjoys rubbing shoulders with tourists from all walks of life, learning about the world beyond the remote mountain area.

"The whole village has seen great changes due to tourism, and our lives have changed too. We lead a well-off life and can stay with our families," she says.

Although she has traveled to other cities, such as Shanghai, for leisure, she finds that her mountainous hometown has a magnetic pull.

Fanjingshan nature reserve is the only habitat of the Guizhou snub-nosed monkey, an endangered primate species. There are six such monkeys at the nature reserve's wildlife rescue center, four of which were born there.

Two monkeys, Xiaotian and Xiaofan, have lived in the center for about 10 years since they were brought in by forest rangers. Xiaotian arrived after being expelled from the troop, while Xiaofan was brought in to the center for an emergency amputation after sustaining a serious injury by falling from a height.

"That's why the duo stay in the center. Also, we can do breeding research for better preservation of the primate species," says Yang Wei, 29, deputy director of the rescue center. "The Guizhou snub-nosed monkeys live in troops. It's necessary to release a group of them into the wild to ensure their survival."

A bond has been forged between Yang and the monkeys at the rescue center. At first they were vigilant and suspicious, and did not allow him to come close, but after a lengthy period of interaction they started to trust him and sometimes even climbed onto his body.

In April, a Guizhou snub-nosed monkey cub was born in the center, and Yang was excited to cut its umbilical cord.

A supervision platform to monitor the monkeys was established



From top: People of the Dong ethnic group from Zhaisha Dong village at the foot of Fanjing Mountain in Guizhou. An ancient temple in the scenic area. Guizhou is a haven of fauna and flora, such as the Guizhou snub-nosed monkeys and rare species of plants.



Injury inspired artisan to be a cut above the rest

BY XU HAOYU and YANG JUN

A small accident led to profound changes in the life of Yang Li of the Miao ethnic group.

In 2011, Yang, from Tongren city in Guizhou province, invented leaf-vein embroidery three months after a leaf cut her hand.

Through continuous learning and practice, she incorporated traditional embroidery of the Miao, Tujia and Dong ethnic groups into the leaves, creating unique art that blends the artificial with the natural.

A single piece of the leaf-vein embroidery sells for between 1,000 yuan (\$138) and 10,000 yuan. Behind the basic financial facts is the more important story of the shared prosperity of embroiderers across the city and the export of culture far beyond its borders.

The embroidery is made from the leaves of rare plants from the Fanjing Mountain scenic area of Tongren city.

The veins are extracted by a process involving more than 30 steps, and then meticulously embroidered by skilled traditional embroidery artisans.

The work is a perfect combination of traditional embroidery patterns and the natural textures of the leaves. It has a unique aesthetic appeal of traditional embroidery matched with the characteristics of contemporary artisanship.

As a native Miao woman with an innate love of embroidery, Yang opened a folklore shop with her sister in 2011. The shop specialized in Miao embroidery, batik coarse cloth and silver jewelry.

"People are becoming less familiar with traditional handicrafts, and I want to contribute all I can to change that situation," Yang says.

At first the small shop did not earn a significant income as there were many similar products on the market. Yang gradually realized that it was important to establish her own brand and market products with distinct features.

That is when she was inspired by the cut. In July 2011, she accidentally cut her hand on a thorny leaf when she was hiking in Fanjing Mountain.

A bold idea came to her: "There are leaf-vein bookmarks and leaf-vein paintings, why has nobody ever

thought of leaf-vein embroidery?" Obviously, the reason is that embroidering on leaves requires a delicacy that few possess.

Yang collected thousands of leaves from the forest in Fanjing Mountain, and after steaming, boiling and tanning, the flesh was removed, exposing the veins. When they dried, the leaves became brittle.

During that time her room was like a swamp, with leaves of all shapes and sizes covering the floor and the smell of decaying plants filling the air.

The biggest technical challenge Yang faced was improving the flexibility of the leaves and making them as soft as cloth.

In September 2011, she visited Shen Min, a local folklore expert and botanist, several times until he told her to soak the leaves in acidic water to weaken the alkalinity of the leaves, thus making the fibers of the veins tough enough to embroider on.

On Oct. 16 of that year, a day she will never forget, Yang finally created a shiny, thin and unbreakable piece of leaf vein. Her idea of leaf-vein embroidery came to fruition after hundreds of experiments.

In November of the same year, her work won her the special award of Guizhou Artisan, fame, and a great number of orders.

Two years later, Yang opened an embroidery processing factory and offered jobs to more than 500 laid-off women workers, rural women, and people with disabilities.

The leaves turn soft after the process, but are also extremely fragile. Yang says that from 2011 to now, fewer than 20 people can independently complete the whole leaf-embroidery process in Tongren. "Usually the embroiderers who can handle the job are those who have already practiced embroidery for decades," she says.

Almost every embroiderer has a collection of handicrafts in her home that could fill a museum, she says.

"Guizhou is a province with a large number of ethnic groups and has a long history of ethnic embroidery skills," she says. "I'm not practicing the leaf-vein embroidery for money. I will keep doing it for the rest of my life because it is meaningful."



Handicrafts of the leaf-vein embroidery, an artisanship created by Yang Li, an embroiderer from Tongren city, Guizhou province.
PHOTOS BY DENG YUZH1 / FOR CHINA DAILY



Yang Li, the leaf-vein embroiderer.

in 2018, with a network of 48 high-definition cameras to enable real-time monitoring.

The monkey population has increased from about 750 in 1992 to more than 800 now, and the area of its habitat expanded from 77 to 135 square miles during the same period.

Zhang Hong, 51, deputy head of Taiping town management station, which administers the nature reserve, is leading a team of forest rangers to do routine fire prevention work.

For the past three months, there has been barely any rain in the region, he said.

Fire engines broadcast fire prevention regulations via a loudspeaker along the road, and forest rangers patrol and promote the importance of fire prevention among local villagers.

The station also provides villagers with induction cookers free of charge to decrease the use of firewood stoves.

Every month Zhang and other forest rangers stay at least 22 days in the station. He has developed deep ties with the nature reserve after working there for more than 30 years.

He says poaching is very rare in the nature reserve as the locals are aware of the importance of wildlife protection.

Wang Jin contributed to the story.

CHINA WATCH

PRESENTED BY CHINA DAILY 中國日報

Foreign firms put trust in resilience

Greater development dividends anticipated as country continues to advance reform and opening-up

**BY LIU ZHIHUA
and FAN FEIFEI**

Halma Plc., a company operating in safety, environment and analysis, and healthcare sectors, announced in September its latest investment in an integrated production, research and development base in Shanghai.

Upon completion, the base will be the largest single integrated site and a critical part of the global supply chain for Halma, a FTSE 100 global group whose headquarters is in the U.K. and that has more than 30 companies operating businesses in China.

That is an example of the bright foreign direct investment outlook for China, especially in high-tech and services sectors.

"China continues to remain a long-term growth driver for us in the next 10 to 15 years," said Aldous Wong, executive board member of Halma and president of Halma Asia Pacific.

"We see China not only as a market, but also a source of innovation. The integrated site will be a valuable step of enhancing our R&D capability and agile supply chain for products that best serve the China and Asia Pacific market."

Experts and business leaders are forecasting that China will attract more foreign investment in the future as its super-sized domestic market continues to expand while its weight in global supply and industrial chains continues to rise with its

steady economic upgrades and high-level opening-up.

That means more of China's development dividends will be shared with foreign companies, which in turn will facilitate cross-border business interaction and China's economic growth, they said.

The actual use of foreign capital in China reached 892.74 billion yuan (\$125.56 billion) in the first eight months of the year, 16.4% more than in the corresponding period last year, the Ministry of Commerce said.

Inbound investment used in the services sector rose 8.7% year-on-year to 662.13 billion yuan during the period. The growth rate in the high-tech sector was 33.6%, including 43.1% for high-tech manufacturing and 31% for high-tech services.

Ingredion Incorporated, a U.S. global ingredient solutions provider, is one of the multinational companies attaching greater importance to supply chains in the country.

The company recently opened a factory called Shandong South in Dezhou, Shandong province, to double its starch production capacity in China. It now has three manufacturing plants in China.

Jacques Guglielmi, vice-president and general manager of North Asia and Asia-Pacific Commercial at Ingredion, said: "With this investment we are positioned for customer success in a world where supply chain resilience and sustainability are more crucial than ever."

The company has witnessed innovations in China and expects strong growth in the

country within the next five years, he said.

The new factory features advanced digital technologies and automation, and is designed to export products worldwide. It can increase Ingredion's capability to deliver consistent products and ensure stability of supply in the region, he said.

Johnson Controls, a U.S.-based smart building solutions provider, is looking to grasp opportunities arising from China's fast-growing new energy vehicle and hydrogen industries, and help drive the digital transformation of traditional industries, said Anu Rathnide, president of Johnson Controls Asia-Pacific.

"China is one of the most important markets for Johnson Controls. The steady growth of the country's digital economy driven by 5G, artificial intelligence and the internet of things, along

with the green development of various industries, have provided us with more opportunities in the Chinese market."

The company will attach great importance to developing and utilizing of new energy in the Chinese market, launch customized solutions for different industries and accelerate the green, low-carbon and intelligent transformation of a wide range of segments covering new energy and intelligent manufacturing, Rathnide said.

Johnson Controls has 11 factories, two research and development centers and more than 40 branches across China.

Frank Meng, chairman of Qualcomm China, said the company was impressed by China's continued efforts to make significant progress in improving its intellectual property system.

"The achievements signal a bright future for China's innovation-driven development strategy. Strong and equal IP protection will further enhance foreign companies' long-term confidence to invest in China."

Over the years China has deepened reform and expanded opening-up to broaden market access for foreign investors, improve the business climate and promote implementation of major foreign investment projects through concrete actions, while transitioning the economy toward the higher value-added end to ensure stable economic upgrade and growth.

**“CHINA
CONTINUES TO
REMAIN A LONG-
TERM GROWTH
DRIVER FOR US
IN THE NEXT 10
TO 15 YEARS.”**

ALDOUS WONG,
EXECUTIVE BOARD MEMBER
OF HALMA AND PRESIDENT
OF HALMA ASIA PACIFIC



From left: Employees on the production line of a foreign-funded electronics company in Hai'an, Jiangsu province, in December. ZHAI HUIYONG / FOR CHINA DAILY
A visitor tries out GTVerse, a mixed reality social network platform, at Qualcomm's booth during the China International Fair for Trade in Services in Beijing in September. ZHANG WEI / CHINA DAILY
An employee works on electronic products at a factory Hai'an, Jiangsu. ZHAI HUIYONG / FOR CHINA DAILY

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A wind farm generates power for grids in Zhoushan, Zhejiang province, on Aug. 6. YAO FENG / FOR CHINA DAILY

Climate change efforts reap praise

BY CHEN WEIHUA

Erik Solheim, former executive director of the United Nations Environment Programme, said he is impressed by China's phenomenal achievements over the past decade in fighting environmental pollution and climate change, and in its march toward sustainable development.

This much is evident to his Twitter followers. Solheim's tweets have included one about China ranking first globally in planted forests and forest coverage growth, contributing a quarter of the world's new forests in the past decade; one about China producing 60% of global solar panels; and another highlighting the fact that 80% of the world's new offshore wind capacity was installed in China last year.

For Solheim, also the former Norwegian minister of the environment and minister of international development, China's achievements on the climate and environmental fronts all started with its fight against pollution.

"The Chinese people wanted to see the beautiful skies over their cities," he said.

"The incredibly fast reduction in air pollution in Chinese cities over the past decade showed how fast China can act. It has now spilled over to renewable

Great improvement in critical figures recorded

energies, nature protection, green cities, electric mobility, tree planting and a lot more."

Figures from China's Ministry of Ecology and Environment confirm Solheim's observations about a decade in which China rapidly switched to a much more sustainable development path.

Huang Runqiu, minister of ecology and environment, said on Sept. 15 that over that time the country has adopted extremely tough measures and made extraordinary progress on protecting the environment.

Thanks to painstaking efforts nationwide to combat pollution, clear waters and blue skies have become more commonplace, he said.

Poor air quality used to be a source of widespread complaints, but the average concentration of PM2.5 hazardous airborne particles fell from 46 to 30 micrograms per cubic meter between 2015 and last year.

About 87.5% of days last year were reported to have had good air quality, up 6.3 percentage points from 2015, making China the country with the greatest air-quality improvement in the world.

Over the past 10 years the

proportion of water at or above Grade III in the country's five-tier water quality system rose 23.3 percentage points to 84.9%, close to the levels in developed countries.

Carbon intensity, or carbon emissions per unit of GDP, has declined by 34.4%, with coal accounting for 56% of total energy consumption, compared with 68.5% 10 years ago.

34.4%

THE DECLINE OF CARBON INTENSITY COMPARED WITH 10 YEARS AGO

China has phased out more than 30 million obsolete heavy-emission vehicles and has become the world's biggest market for new energy vehicles as well as the world's largest investor, producer and user of renewable energy.

A Bloomberg report, quoting a study published in June by the Energy Policy Institute of the University of Chicago, also highlighted China's achievements. It showed that the amount of harmful particulates in the air in the country fell 40% between 2013 and 2020, a decrease that could add about two years to the average life expectancy if sustained.

"China's success in reducing pollution is a strong indication of the opportunities that could lie

ahead for other nations if they were to impose strong pollution policies," researchers concluded.

President Xi Jinping announced via video link to the 75th session of the United Nations General Assembly in September 2020 that China will reach peak carbon emissions before 2030 and achieve carbon neutrality before 2060.

China has also promised that by 2030, 25% of its energy will be derived from renewable sources and that it will reduce carbon intensity by more than 65%, achieve a combined capacity of solar and wind power generation of 1.2 billion kilowatts and boost forest stock volume by about 210 billion cubic ft. from the 2005 level.

In a recent paper Nicholas Stern, chairman of the Grantham Research Institute on Climate Change and Environment at the London School of Economics and Political Science, and his colleague Chunping Xie applauded Xi's pledge to the UN General Assembly.

"This significant pledge shows China's long-term ambitions and priorities, and that the Chinese government has linked low-carbon development and carbon-neutral transition with the country's sustainable development and long-term prosperity," they said.

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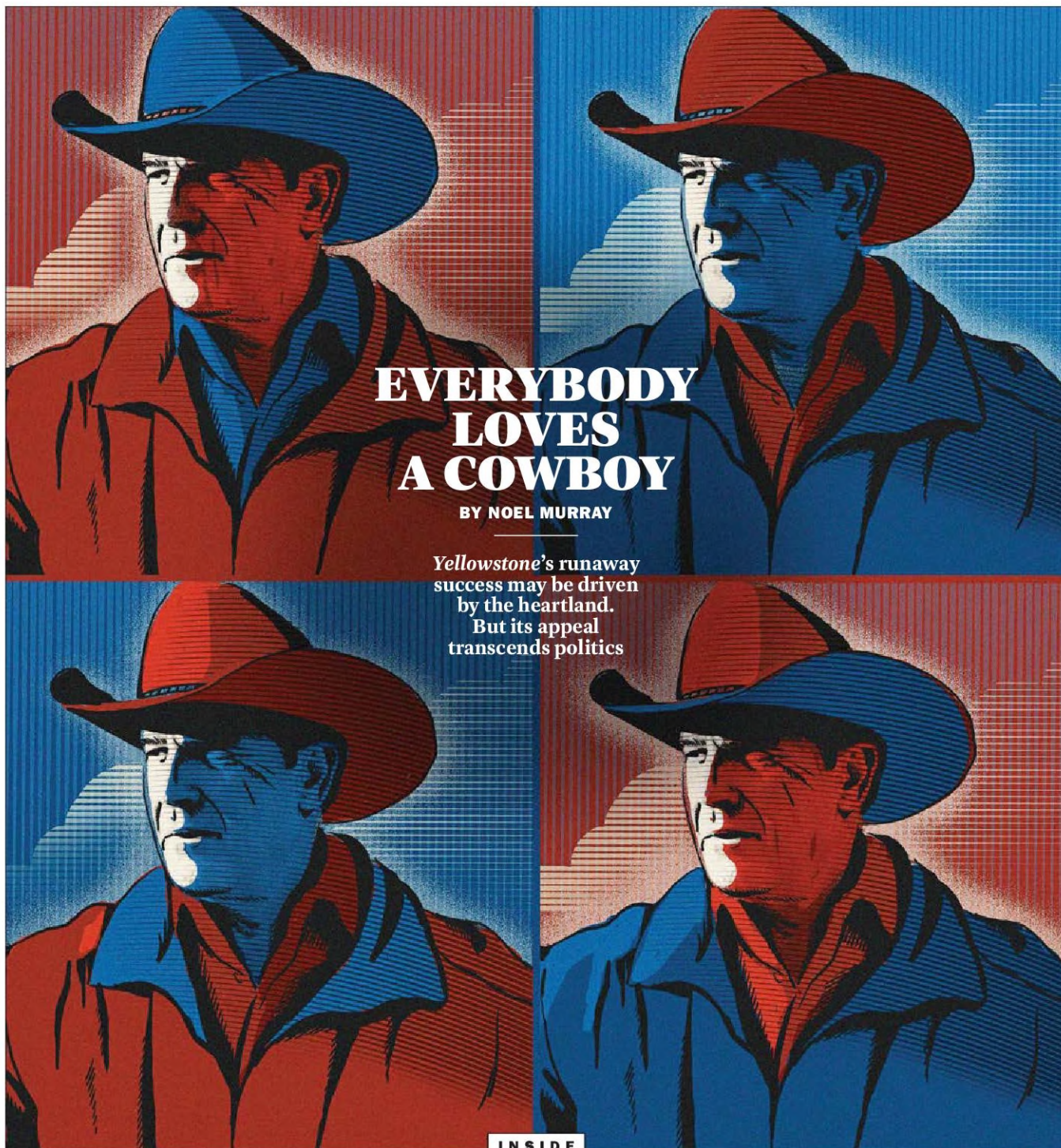
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Time Off



EVERYBODY LOVES A COWBOY

BY NOEL MURRAY

*Yellowstone's runaway
success may be driven
by the heartland.
But its appeal
transcends politics*

INSIDE

A NOVEL ABOUT DIVORCED ONE-PERCENTERS
DOESN'T TRANSLATE ONSCREEN

LAUREN GRAHAM REVISITS NORA EPHRON'S
WISDOM ON AGING

ILLUSTRATION BY CHRIS GALL FOR TIME

TIME OFF OPENER

IN MARCH 2018—THREE MONTHS BEFORE THE HIT Paramount Network drama *Yellowstone* debuted—an Alberta, Canada, woman who goes by the internet handle *Tori F.* began creating social media accounts under the heading “Yellowstone TV Fans.” *Tori F.* had been building fan spaces online since the mid-2000s; and as an admirer of the actor Kelly Reilly (who plays *Yellowstone*’s ruthless, damaged businesswoman Beth Dutton), she saw a lot of potential in this show. It looked to be both a western and a family melodrama, two genres underrepresented on TV. More important, it looked pulpy and fun. She says, “I was on the lookout for something new, for a Sunday-night watch party with friends.”

Right away, though, *Tori F.* noticed something different about the *Yellowstone* fans she was interacting with online. They were 10 to 20 years older than most people who gab about TV on the internet. And they were mostly scattered across the U.S. heartland—not in big coastal cities.

Since 2018, *Yellowstone* has become one of the most-watched scripted dramas on cable, often outdrawing shows on major networks. January’s fourth-season finale had over 9 million viewers the night it aired (excluding those who streamed it later), nearly double the number who watched the Season 3 finale. By comparison, the Emmy-winning, critically acclaimed HBO drama *Succession*, which tells a similar story about a wealthy family fighting to hold on to its place in the modern world, drew 1.7 million on all platforms (including some 600,000 watching on cable) for its third-season finale a few weeks earlier.

But who is watching *Yellowstone*? That’s a question that tends to perplex people who write about TV for a living. When the show’s fifth season debuts on Nov. 13, it will likely dominate the ratings yet again, all while drawing little attention from major media outlets or the people who hand out awards (it has been nominated for one Emmy). Rotten Tomatoes links to 10 critic reviews for its fourth season, vs. 141 for *Succession*’s third.

When *Yellowstone* does get written about, it’s often described as a “red-state show,” loved more by Texas gun toters than Brooklyn hipsters. That’s not entirely wrong. Networks hold on tightly to detailed demographic data, but at the end of Season 2, Paramount’s website touted huge viewership in cities like Dallas, Oklahoma City, and Fort Myers, Fla. Woke Hollywood may read that as a fandom of book-banning suburban moms and angry dudes in MAGA hats, but it’s not that simple. At a time when audiences are fragmented and frequently seem only to want to watch people who think and look like themselves on TV, it’s apt that a show that shares its name with a river has found success by being mainstream.

WHILE IT’S TRUE that a lot of big hit shows have only a minimal presence in the larger popular culture—no one’s handing out Emmys or writing weekly think pieces about *NCIS: Hawaii*, after all—it sure feels as if *Yellowstone* should be discussed more. Its star, Kevin Costner, is an Oscar winner. Co-creator and showrunner Taylor Sheridan wrote the critically acclaimed movies *Sicario* and *Hell*



▲
Costner’s John Dutton is a mighty Montana rancher

or *High Water*. His stories tackle corporate greed, class conflict, racial identity—all topics that usually get cultural commentators excited.

Republicans who support candidates vowing to protect faith, family, and the Second Amendment could certainly be drawn to Costner’s John Dutton, a rugged Montana ranching magnate who pines for the good old days and uses brute force against his political enemies. But the show does not seem to be trying to actively court that crowd. *Yellowstone*’s premise is in line with those of classic nighttime soaps like *Dallas*, in which nearly every character has a little bit of angel and a little bit of devil in them, and where the stories sometimes dispense with logic to get to the next cliff-hanger. The issues *Yellowstone* raises about land stewardship and big business are relevant, but the plots are more about romance, violence, and feuds—all played out against a gorgeous Montana backdrop.

The 170,000-plus followers on *Tori F.*’s Facebook page are mostly focused on those soapy elements. They speculate about big plot twists and generate memes. (One popular recurring bit of fan shtick is someone posting “I watch *Yellowstone* for the



plot,” followed by images of hunky cowboys.) Fans also pine for life on the Duttons’ sprawling, picturesque spread, where anybody who’s willing to work can become part of the family.

Katie Bowlby is the digital director of *Country Living* magazine, which has covered *Yellowstone* extensively because, she says, “it is in line with our readership.” She agrees that the appeal goes beyond politics, and finds the show is enjoyed fairly equally by men and women. In the age of streaming, it’s “appointment viewing”: a series everyone makes a point to watch when it airs, so they can talk about it the next day. She adds, “The average American doesn’t care if the show they watch is nominated for an Emmy or gets attention from some critics. They watch it because it’s entertaining.”

Bowlby also suggests that *Yellowstone* “is a bit of a contrast to a lot of what you see on television now, with its wide open spaces and the celebration of nature.” That’s especially appealing when nearly every other show takes place in cramped offices and cluttered apartments. It’s what makes *Country Living* successful, as well as other rural-themed lifestyle publications that appeal both to people who

live on ranches and to people who live in cities and dream about ranches. See also: *Cowboys & Indians* magazine, which has covered *Yellowstone* alongside Native American fashion and the best places to buy rustic-looking furniture. Or Ree Drummond’s *The Pioneer Woman* franchise, which sells a cheerful image of a hardworking family living off the land.

If the *Yellowstone* audience has expanded—the ratings nearly doubling year over year since the first season—Bowlby thinks one reason is the pandemic, when people stuck at home all over the country binged the series. (In a strange showbiz quirk, the streaming rights were sold to Peacock before it became a hit, and before the service formerly known as CBS All Access rebranded as Paramount+. All of its spin-offs—last year’s *1883*, this year’s *1923*, and the as-yet-unscheduled *6666*—are on Paramount+.)

Bowlby’s take is seconded by David Glasser, a *Yellowstone* producer, who admits that “in the beginning, the audience was everywhere but the coasts.” These days, though, he runs into fans of all ages all over—including at his daughter’s college, where he says he recently talked with a bunch of fraternity brothers in *Yellowstone* hats who wanted to ask about Cole Hauser’s macho fan-favorite ranch foreman Rip Wheeler. He thinks the show connects broadly because everyone has a family, even if they’re not quite like the dysfunctional Duttons.

That said, to devout *Yellowstone* fandom, there is an element of “This show is for us and only us.” As Bowlby says, “The Western lifestyle is alive and well. There are people who live on ranches, work the land, and compete in rodeos. That’s a big element of American culture that gets overlooked.”

I can vouch for this. I live in Arkansas, where kids often engage in

typical adolescent pastimes like sports and band while also raising livestock to show at regional fairs. Whenever I have a casual conversation about TV around here, I invariably hear, “Do you watch *Yellowstone*?” My staunch Southern Baptist father-in-law has sampled the show, and although he didn’t stick with it (because of all the sex and swearing), that people in his circles were pushing it on him in the first place says something. For some, watching *Yellowstone* has practically become a social requirement.

TORI F. ADMITS that although most *Yellowstone* fans just want to hop online to talk about the Duttons, there are times and spaces—on Facebook especially—when the fandom “gets a little Wild West.” She recalls that when she shared Paramount Network’s support for the Black Lives Matter movement in 2020, “it kicked off this whole three-week insanity of people fighting in the comments.” She mentions death threats and doxxing, lamenting, “It was the first time I had seen that type of thing for *Yellowstone*.”

The show itself is fairly evenhanded. The dialogue and stories earnestly advance multiple points of view—be it conservative landowners protecting their legacies, Indigenous activists reclaiming their land, environmentalists stopping exploitation, or career politicians doing what they do. Tori F. says, “If you dig into it, you can probably see where the fans’ opinions default. But I think the show does a good job of not pitching to one side.” She adds, “A lot of my friends describe *Yellowstone* as a red-state show made by blue-state people.”

For Glasser, it’s even simpler. He says Sheridan is mostly interested in “giving audiences something to come back for.” Who watches—and why—are secondary to the *Yellowstone* boss’s interest in doing what Tori F. was looking for back in 2018. He wants to conjure up a good, involving story, to be enjoyed alongside other people. As Glasser puts it, “When Taylor sits down to write at his computer, there is no notepad, no outline cards; there’s no writers’ rooms. It’s just the Duttons and Taylor, and his heart and soul.” □

‘A lot of my friends describe *Yellowstone* as a red-state show made by blue-state people.’

TORI F., YELLOWSTONE FAN CLUB CREATOR

TIME OFF TELEVISION



◀
Toby (Eisenberg, center) keeps it together for the kids

REVIEW

Divorce, Manhattan style

BY JUDY BERMAN

WHEN A MAN ABANDONS HIS FAMILY, THAT IS NOT NEWS, because it happens so often. But if a woman does it, that is news. It's also the man-bites-dog premise of *Fleishman Is in Trouble*, Taffy Brodesser-Akner's celebrated 2019 novel turned FX on Hulu miniseries, in which an Upper East Side physician flails his way through a divorce. One morning, Toby Fleishman (a perfectly cast Jesse Eisenberg) awakens in his sad new apartment to find that his ex Rachel (Claire Danes) has left their two kids there in the middle of the night. Then she stops answering her phone, for days that turn into weeks.

Rachel is a monster, right? A top theater agent, she's always been too busy to spend much time with 11-year-old Hannah (Meara Mahoney Gross) and 9-year-old Solly (Maxim Swinton). Which must make Toby the hero. Well, not so fast. The whole point of *Fleishman*, a clever thought experiment of a book that doesn't quite work onscreen, is that there's more than one side to the story.

The show gives us Toby's version, at excessive length, first. Unshackled from a wife who sees his calling as a glorified hobby (and his \$300K salary as a pittance), this erstwhile nebbish discovers he's now a hot dating-app commodity. Yet even before Rachel disappears, separation is no panacea. Anxious and aggrieved by nature, he stresses over a potential promotion to which he feels entitled. Casual sex is fun, but he's still lonely enough to want to reconnect with old friends like Libby (Lizzy Caplan), a former journalist and current disgruntled stay-at-home mom, whose

voice-over narration frames the show.

Fleishman is an exercise in inversion. Directors including *Battle of the Sexes* duo Valerie Faris and Jonathan Dayton riff on the best seller's cover, an upside-down Manhattan skyline, in queasily tilted shots. It isn't just Toby and Rachel whose marriage represents a reversal of traditional gender roles, either. Once desperate for the approval of her colleagues at a men's magazine, Libby flips the script by telling a man's story—and making space for perspectives like Rachel's.

IT'S A SMART CONCEIT: Philip Roth meets *Gone Girl*. But it invites scrutiny the novel can't support. Through Libby's eyes, Toby's father-of-the-year journey is really a tale of men's entitlement and women who are punished for their ambition. (Set in the summer of 2016, the show pounds home the point with Hillary signs everywhere.) Step back, however, and you might find it hard to care about any of these self-obsessed one-percenters, male or female. "Forget rich white guys—rich white ladies are the real victims" isn't exactly revolutionary thinking.

Helmed by Brodesser-Akner, the FX series reproduces the book's blind spots. The bigger problem is the adaptation itself. The dialogue is sharp and the actors great—especially Danes, whose talent for channeling big emotions gets a glorious showcase. Scenes of old friends bantering have a natural flow. But the pace is plodding, and the ever present voice-over turns long stretches of the show into lectures, with the actors reduced to visual aids. When *Fleishman* works as a novel, it's thanks to Brodesser-Akner's skill at using the conventions of literature to explore perspectives that male writers rarely bother to imagine. When it falls apart onscreen, it's because the medium no longer mirrors the message.

***Fleishman Is in Trouble* is an exercise in inversion**

FLEISHMAN IS IN TROUBLE comes to Hulu on Nov. 17



New York's divinest: Avraham Avraham (Wilbusch)

REVIEW

A MISSED CALLING

A new show from David E. Kelley, the veteran creator behind *Big Little Lies* and *Ally McBeal*, used to be an event worth anticipating. But lately the demand for Kelley's brand of smart yet soapy dramas has exploded. Presumably stretched thin, he seems to have a disappointing new thriller or procedural out on a different platform every month: *The Undoing*, *Nine Perfect Strangers*, *Anatomy of a Scandal*, *The Lincoln Lawyer*, and so on.

The Calling, an adaptation of Dror Mishani's books about a Jewish detective with the unlikely name Avraham Avraham, is his offering to Peacock. Directed by Barry Levinson, the series casts Jeff Wilbusch (*Unorthodox*) as the brilliant, intense, ascetic, deeply spiritual NYPD lone wolf who's looking into a teen boy's disappearance. The case gets complicated, as they always do. Avi's manipulative methods start to upset his colleagues—a standard occupational hazard for genius TV cops. Framed as a maverick, he's really just a stock antihero with a Talmudic twist.

If you've watched enough Kelley to know that his men are ogres and his women victims and enablers, the plot will feel familiar. Scripts lean on pop psychology and cliché ("I don't know my husband anymore"). The show isn't incompetent; it held my attention, for the most part. It's just a shame to watch Kelley keep churning out mediocrities. —J.B.

THE CALLING debuts Nov. 10 on Peacock

REVIEW

Violence and tenderness converge in the Wild West

FOR THE EUROPEANS WHO COLONIZED it in the 19th century, the American West promised money and freedom. Civilization was an afterthought, except within the Indigenous communities they massacred and displaced. The conflict between ruthless, lawless self-interest and the human instinct to form bonds of mutual care has always been central to the western genre. Yet it's rare to see a variation on the theme achieve the depth and poignance of *The English*.

The insightful, six-episode Amazon-BBC miniseries opens with a chance encounter. Upon arriving at a dusty hotel in the desolate Kansas of 1890, Lady Cornelia Locke (Emily Blunt) finds Eli Whipp (Chaske Spencer) beaten and chained outside. She's an English aristocrat on a mission to kill the man who killed her son. He's a newly retired Pawnee scout traveling north to claim land he's owed. She saves him, then he saves her. Unlike so many other strangers who cross paths on these eerily empty plains, they immediately earn each other's trust.

As they ride, it becomes apparent

that they share more than a direction. Known for the complexity of both his plots and the moral quagmires he creates, writer and director Hugo Blick populates their path with ghoulish characters who harbor all sorts of wild, self-serving beliefs about loyalty, revenge, identity. *The English* suggests that these mismatched convictions converged in an impossible fantasy called the United States of America.

TV's greatest western, *Deadwood*, arrived at a similar conclusion, citing the adage that "history is a lie agreed upon." The story of Cornelia and Eli is a different kind of fiction, and one whose occasional sentimentality only slightly undermines its elegance as a counternarrative. Violent, macabre, and in many ways tragic, *The English* doesn't deny what really happened when cultures collided on the frontier. Instead, it finds beauty in imagining how more humane people in the same situation, united by trust, might have begun to build something better. —J.B.

THE ENGLISH comes to Amazon on Nov. 11



A daughter of privilege (Blunt) seeks justice on the frontier

TIME OFF BOOKS

ESSAY

The funny thing about aging

BY LAUREN GRAHAM

YEARS AGO, I WAS IN AMSTERDAM WITH ONE OF MY friends, Jen, when I tripped and fell for absolutely no reason. I lay on the ground for a moment in shock. I wasn't hurt or anything, I was just surprised. My shoes were tied, the pavement was smooth, and I hadn't been wildly weaving or jumping around. And yes, I was a little high (Amsterdam), but not in a way that would have led to forgetting how to walk. I looked up from the ground and said, "Jen! Gah! What if, someday, I become one of those people who just falls for no reason?" We found this idea so outrageous that we laughed and laughed. Because to me, lying there, barely into my early 30s, falling for no reason was something that happened only to old people.

Fast-forward to one day soon after I turned 50, and I again fell for no reason. I slipped on the stairs and tried to save the iPad I was holding. The iPad survived, but my foot was broken. Later that year, on a ski trip, I fell again and broke my wrist. I wish I could tell you I was skiing when it happened, but I was merely walking to lunch. The broken wrist was a more serious injury, and I still have a Frankensteinian amount of metal in there holding it all together.

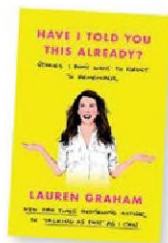
I'm not sure when exactly it is that you don't feel as young as you used to, but spending a day purchasing specialty items from a hospital supply store might be one indication. I'd never been to such a place before, but in just one year I went several times. Suddenly, my freezer was full of gel packs that could be inserted into slings and Velcro foot wraps, and I was forever driving to Beverly Hills to get parts of myself X-rayed. As a result of these injuries, not to mention turning 50, I started to think a lot more about what it means to get older. It occurred to me that I had attended a legend's 60th-birthday party. Sixty had once seemed impossibly far away, but I was now closer to that number than I felt—and no amount of spa treatments or fasts could do anything about that.

WHEN I TALK about aging, I'm not talking about the Terrible Horrible stuff, the serious diseases or conditions. I'm talking about things that are mainly just annoying but also mystifying in that they show up without warning. I'm talking about the moment you realize you've turned 2 p.m.-Sunday-matinee years old because going to Times Square at 8 p.m. seems like a ridiculous thing to do, and suddenly your entire lunch conversations revolve around the best cream for sore joints. On the one hand, this development is OK because you have people with whom to discuss these things over steamed vegetables and mashed potatoes because spicy foods just don't agree with you anymore. On the other hand, this change sneaks up on you, and like any sneak, it gives you a bit of a scare.

Of course, I'd thought about aging before; I work in

an industry obsessed with how people look. But the concept that this getting-older thing was a train that moved in only one direction had somehow not fully struck me until the year of broken bones.

That same year, in therapy, I compared my feelings of being panicked to Joan Cusack racing to get the videotape to the newsroom in *Broadcast News*, and the therapist looked at me blankly. That my film references were not those of my slightly younger therapist, and that professionals to whom I entrusted my care were now younger than I, was another change I didn't see coming. You spend years looking up to people older than you and figuring they know things you'll someday know too, then one day you're seeking advice from a doctor who (hopefully) knows more than you do except for not having seen *Broadcast News*, and life's questions become more complicated: Can you really trust someone with your mental health who doesn't have every Jim Brooks movie memorized? Maybe you knew more than you thought you did when you thought older people knew more?



Graham's
new collection
features
15 essays

DURING THE YEAR of broken bones, I reread all of Nora Ephron's essays. One bothered me in a way it hadn't before: "I Feel Bad About My Neck" is a brief, funny essay in the book of the same title. It's also in a collection called *The Most of Nora Ephron*, which is one of my treasured bedside-table books. In this piece, she notices herself and her friends trying every type of shirt collar and turtleneck sweater to hide their aging necks, and concludes in her sharp way that it's a shared fate, part of life, and there's nothing really to be done about it.

I cannot possibly say anything about aging, or anything else, better than Ephron said it, and I'm not going to try. It just bothers me that this incredible woman had anything to worry about regarding her neck. She wasn't going to be filmed and picked apart over it, because she wasn't an actor and Twitter hadn't been invented yet. But still, she worried enough to turn it into comedy.

When my mother's cancer came



back a second time, years after she'd been in remission, this is how she told me: "Well, at least I won't have to get a face-lift." This was her gallows humor, but also a thought I knew she'd really had. Death vs. maintaining youthful beauty should not be a competition. Sometimes, a person will tell me that I "look exactly the same" as I did years before. And I always think, No, I don't, and if I did it would not be due to natural practices—and what kind of pressure is that?

In Ephron's essay, she acknowledges that she could have work done on her neck, but that would mean having to get a face-lift—which she would never do. So, she resigns herself to living with it and moves on. Today, the line is blurrier. You can still draw a line at face-lifts, but there are all sorts of lasers that (supposedly) tighten your skin, machines that (supposedly) shrink fat cells, injections that (supposedly) restimulate collagen production. And there are "threads," which are barbed-wire-shaped lengths of some other substance designed to be shot into your face at

At what point is it OK to stop trying to 'look exactly the same'?

various points to lift it up. But it will sag again eventually as the substance is absorbed, like a slowly dissolving clothesline.

You might think we in Hollywood all know who is doing what and can therefore decide what works, but we don't. The people who know are the makeup artists, and none of the good ones name names. They might tell you what's trending, but they won't say who's doing it. They might call their A-listers "Everyone," as in "Everyone is loving the threads. Everyone thinks CoolSculpting doesn't work."

I wish "Everyone" would just publish their activities to be studied in a medical journal for aging actors. That way we could all distinguish between what's real and what's fake, what are the results of genetic blessings and what are the results of pricey doctor's visits, and then decide for ourselves.

The me that looked my "best" was a me that smoked, was underfed, ran high with anxiety, didn't get enough sleep, and still never felt good enough. And gradually, whatever that machine was and whatever adrenaline was fueling it began to break down, and I just couldn't do it anymore. It was around that time that I began to wonder: At what point is it OK to stop trying to "look exactly the same"?

Maybe there's a reason there aren't as many men writing about aging, and the reason isn't that they aren't thinking about it. Maybe—like my mother did, like Ephron did—turning fears about aging and mortality into contemplation and comedy is just one of those things women are better at. And perhaps this is not a burden but should be a point of pride. We get to bond with one another with a more constructive—even joyous—response to fears about middle life and its injustices than, say, buying a flashy sports car (unless that gives you joy). Maybe the through line here is "Let's all give up!"—a resigned but cheery call to inaction. All the Restylane in the world won't make 80 the new 30, so why not laugh about it?

Graham is the author of Have I Told You This Already?, from which this essay is adapted

8 QUESTIONS

F. Murray Abraham The Oscar-winning actor talks about the new season of *The White Lotus* on HBO, acting in his ninth decade, and growing up on the Mexican border

Your character on *The White Lotus*, Bert, is a flatulent, crass woman-izer. How did you relate to him?

They're in my family. I'm 83 and come from an era where that was very common. They're funny people: they're so insensitive, but at the same time, loving and kind and generous. But they do have a blind spot when it comes to women, no question about that. I was raised that way. What a great relief, to become a feminist. As a man, I don't have to carry the world on my shoulders.

You called acting an "awful, awful profession" in a 1986 interview. Would you agree now?

When it's bad, it's awful. Eighty-five percent of actors in the union are out of work, always. [One study says 90%.] There were times when I was out of work for six, seven months. You begin to doubt, to forget who you are. You can make a living as a waiter; you try, anyway. But that's not who you are.

But when it works, it's great. I don't think I'm ever more alive than when I'm onstage. And that's a hell of a thing to say, because I have a wonderful life, really.

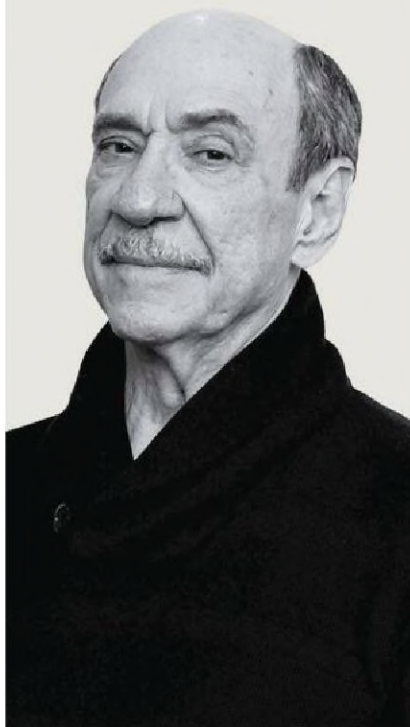
You've delivered *King Lear* so-liloquies and crude masturbation jokes alike. Do you approach them with the same part of your brain?

It certainly is the same craft and the same exuberance. Frankly, if I had a choice, it would always be comedy. The thing about Salieri [whom he played in the 1984 film *Amadeus*] which people don't mention: they make him out to be a villain. In fact, the older Salieri is pretty funny.

You go to the same well, whether it's comedy or farce: you're looking for the truth. So you do farce completely serious: you mean these stupid things you say. With Bert, it's just the truth, that masturbation is important every day. Ask any doctor.

You've played heroes, villains, and comic relief. When you pick up a script now, what qualities do you look for?

You want a great script and a great character. I'd love to be a hero, a lover. An 83-year-old man who discovers love. Older people don't get a fair shake about that. You're still capable of loving.



Do you feel more or less motivated in your acting than in decades past?

More. I feel like I'm running out of time. There's a lot to do. If I live to 100, that's only 17 years. It ain't enough time. So I look forward to my work now as I always have. That's what's so astonishing about my good luck. There's a lot of talent out there and they just can't get arrested, as we say in the business.

You grew up in El Paso, Texas, two blocks from the Rio Grande.

What kind of perspective did that upbringing give you about the current immigration debates? This is a tragedy. I used to practically live in Juárez [Mexico]: I went to school and had dinner with the people that lived there. It wasn't dangerous. Some of them didn't speak English very well, and I learned some Spanish from them. Now, this is a different world. I think it's a real tragedy that the border is not a place of free exchange between cultures.

You're also part Syrian. Have the Arabic roles you've played changed over the course of your career?

I think originally because of my name, I got a lot of Jewish parts. Some of the best performances of my life were my portrayals of Jews, like Roy Cohn [in *Angels in America*], a character I have no regard for. After it became known I was Syrian, they started offering me Arabic roles. The Jewish parts are much richer. They don't draw Arabs very well. Usually they're bad guys.

You're a longtime theater teacher. What advice do you give your students?

I still teach once or twice a year, for free: I just do it because I like it. Every class, I start and end by saying, "Don't be afraid." That's it.

—ANDREW R. CHOW

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